KNOWLEDGE
AN ILLUSTRATED
MAGAZINE OF SCIENCE
PLAINLY WORDED—EXACTLY DESCRIBED

*LONDON: FRIDAY, OCT. 24, 1884.*

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# THE CHEMISTRY OF COOKERY.

By W. Mattieu Williams.

## XLV.—COCOA AND THE COOKERY OF WINE.

A CORRESPONDENT writes to the Editor asking whether I class cocoa amongst the stimulants. So far as I am able to learn, it should not be so classed, but I cannot speak absolutely. Mere chemistry supplies no answer to this question. It is purely a physiological subject, to be studied by observation of effects. Such obsevations may be made by anybody whose system has not become "tolerant" of the substance in question. My own experience of cocoa in all its forms is that it is not stimulating in any sensible degree. I have acquired no habit of using it, and yet I can enjoy a rich cup or bowl of cocoa or chocolate just before bed-time without losing any sleep. When I am occasionally betrayed into taking a late cup of coffee or tea, I repent it for some hours after going to bed. My inquiries among other people, who are not under the influence of that most powerful of all arguments, the logic of inclination, have confirmed my own experience.

I should, however, add that some authorities have attributed exhilirating properties to the *theobromine* or nitrogenous alkaloid of cocoa. Its composition nearly resembles that of theine, as the following (from Johnstone) shows:—

| | Theine. | | Theobromine. |
|---|---|---|---|
| Carbon | 49·80 | ..... | 46·43 |
| Hydrogen | 5·08 | ..... | 4·20 |
| Nitrogen | 28·83 | ..... | 35·85 |
| Oxygen | 16·29 | ..... | 13·52 |
| | 100·000 | | 100·000 |

It exists in the cocoa bean in about the same proportion as the theine in tea, but in making a cup of cocoa we use a much greater weight of cocoa than of tea in a cup of tea. If, therefore, the properties of theobromine were similar to those of theine, we should feel the stimulating effects much more decidedly.

The alkaloid of tea and coffee in its pure state has been administered to animals, and found to produce paralysis, but I am not aware that theobromine has acted similarly.

Another essential difference between cocoa and tea or coffee is that cocoa is, strictly speaking, a food. We do not merely make an infusion of the cacao bean, but eat it bodily in the form of a soup. It is highly nutritious, one of the most nutritious foods in common use. When travelling on foot in mountainous and other regions, where there was a risk of spending the night *al fresco* and supperless, I have usually carried a cake of chocolate in my knapsack, as the most portable and unchangeable form of concentrated nutriment, and have found it most valuable. On one occasion I went astray on the Kjolenfjeld, in Norway, and struggled for about 24 hours without food or shelter. I had no chocolate then, and sorely repented my improvidence. Many other pedestrians have tried chocolate in like manner, and all I know have commended its great "staying" properties, simply regarded as food. I therefore conclude that Linnæus was not without strong justification in giving it the name of *theobroma* (food for the gods), but to confirm this practically the pure nut, the whole nut, and nothing but the nut (excepting the milk and sugar added by the consumer) should be used. Some miserable counterfeits are offered—farinaceous paste, flavoured with cocoa and sugar. The best sample I have been able to procure is the ship cocoa prepared for the Navy. This is nothing but the whole nut unsweetened, ground, and crushed to an impalpable paste. It requires a little boiling, and when milk alone is used, with due proportion of sugar, it is a *theobroma*. Condensed milk diluted and without further sweetening may be used.

In my last I promised the results of my investigations concerning the source of the sulphate of potash that I found replacing the natural tartrate in so many samples of sherry.

At first I hunted up all the information I could obtain from books concerning the manufacture of sherry, learned that the grapes are usually sprinkled with a little powdered sulphur as they are placed in the vats prior to stamping. The quantity thus added, however, is quite insufficient to account for the sulphur compounds in the samples of wine I examined. Another source is described in the books—that from the sulphuring the casks. This process consists simply of burning sulphur inside a partially-filled or empty cask, until the exhaustion of free oxygen and its replacement by sulphurous acid renders further combustion impossible. The cask is then filled with the wine. This would add a little of sulphurous acid, but still not sufficient.

Then comes the "plastering," or intentional addition of gypsum (plaster of Paris). This, if largely carried out, is sufficient to explain the complete conversion of the natural tartrates into sulphates of potash, but such plastering is admitted to be an adulteration or sophistication, and the best makers deny their use of it. I obtained samples of sherry from a reliable source, which I have no doubt the shipper honestly believed to have been subjected to no such deliberate plastering; still, from these came down an extravagantly excessive precipitate on the addition of chloride of barium solution.

At last I learned that "Spanish earth" was used in the fining. Why Spanish earth in preference to isinglass or white of egg, which are quite unobjectionable and very efficient? To this question I could get no satisfactory answer directly, but learned vaguely that the fining produced by the white of egg, though complete at the time, was not permanent, while that effected by Spanish earth, containing much sulphate of lime, is permanent. The brilliancy thus obtained is not lost by age or variations of temperature, and the dry sherries thus cooked are preferred by English wine-drinkers.

Here, then, is a solution of the mystery. The sulphate

of potash which is thus made to replace bitartrate is so readily soluble that neither changes of temperature nor increase of alcohol, due to further fermentation, will throw it down; and thus the wine-merchant, without any guilty intent, and ignorant of what he is really doing, sophisticates the wine, alters its essential composition, and adds an impurity in doing what he supposes to be a mere clarification or removal of impurities.

I have heard of genuine sherries being returned as bad to the shipper because they were genuine, and had been fined without sophistication. Are we to blame the wine-merchant for this? I think not.

My own experience of genuine wines in wine-growing countries teaches me that such wines are rarely brilliant; and the variations of solubility of the natural salt of the grape, which I have already explained, shows why this is the case. If the drinkers of sherry and other white and golden wines would cease to demand the conventional brilliancy they would soon be supplied with the genuine article, which really costs the wine-merchant less than the cooked product they now insist upon having. This foolish demand of his customers merely gives him a large amount of unnecessary trouble.

So far, the wine-merchant; but how about the consumer? Simply that the substitution of a mineral acid—the sulphuric for a vegetable acid (the tartaric)—supplies him with a precipitant of lithic acid in his own body; that is, provides him with the source of gout, rheumatism, gravel, stone, &c., with which *English* wine-drinkers are proverbially tortured.

I am the more urgent in propounding this view of the subject because I see plainly that not only the patients, but too commonly their medical advisers, do not understand it. When I was in the midst of these experiments I called upon a clerical neighbour, and found him in his study with his foot on a pillow, and groaning with gout. A decanter of pale, choice, very dry sherry was on the table. He poured out a glass for me and another for himself. I tasted it, and then perpetrated the unheard-of rudeness of denouncing the wine for which my host had paid so high a price. He knew a little chemistry, and I accordingly went home forthwith, brought back some chloride of barium, added it to his choice sherry, and showed him a precipitate which made him shudder. He drank no more dry sherry, and has had no serious relapse of gout.

In this case his medical adviser prohibited port and advised dry sherry.

The following from "The Brewer, Distiller, and Wine Manufacturer," by John Gardner (Churchill's "Technological Handbooks." 1883), supports my view of the position of the wine-maker and wine-merchant. "Dupré and Thudicum have shown by experiment that this practice of plastering, as it is called, also reduces the yield of the liquid, as a considerable part of the wine mechanically combines with the gypsum and is lost." When an adulteration—justly so-called—is practised, the object is to enable the perpetrator to obtain an increased profit on selling the commodity at a given price. In this case an opposite result is obtained. The gypsum, or Spanish earth, is used in considerable quantity, and leaves a bulky residuum, which carries away some of the wine with it, and thus increases the cost to the seller of the saleable result.

Having referred so often to dry wines, I should explain the chemistry of this so-called dryness. The fermentation of wine is the result of a vegetable growth, that of the yeast, a microscopic fungus (*Pencillium glaucum*). The must, or juice of the grape, obtains the germ spontaneously—probably from the atmosphere. Two distinct effects are produced by this fermentation or growth of fungus: first, the sugar of the must is converted into alcohol; second, more or less of the albuminous or nitrogenous matter of the must is consumed as food by the fungus. If uninterrupted, this fermentation goes on either until the supply of sufficient sugar is stopped, or until the supply of sufficient albuminous matter is stopped. The relative proportions of these determine which of the two shall be first exhausted.

If the sugar is exhausted before the nitrogenous food of the fungus, a dry wine is produced; if the nitrogenous food is first consumed, the remaining unfermented sugar produces a sweet wine. If the sugar is greatly in excess, a *vin de liqueur* is the result, such as the Frontignac, Lunel, Rivesaltes, &c., made from the muscat grape.

The varieties of grape are very numerous. Rusby, in his "Visit to the vineyards of Spain and France," gives a list of 570 varieties, and as far back as 1827 Cavalow enumerated more than 1,500 different wines in France alone.

From the above it will be understood that, *cæteris paribus*, the poorer the grape the drier the wine; or that a given variety of grape will yield a drier wine if grown where it ripens imperfectly, than if grown in a warmer climate. But the quantity of wine obtainable from a given acreage in the cooler climate is less than where the sun is more effective, and thus the *naturally* dry wines cost more to produce than the *naturally* sweet wines.

This has promoted a special cookery or artificial drying, the mysteries of which will be discussed in my next.

## NOTES ON COAL.

By Richard A. Proctor.

(*Continued from page* 297.)

If we now turn to the consideration of the extent of the earth's surface occupied by those particular strata which belong to the coal period, we find evidence of the existence of enormous quantities of available coal. Professor Ansted mentions that a quarter of a million of square miles of the earth's surface "are covered with sandstones and shales of the carboniferous period among which coal is buried; and this coal is for the most part accessible." Now there are upwards of three million square yards of surface in a square mile; and, assuming an average total thickness of ten yards for all the distinct seams of each coal-field, we find for the total number of cubic yards of available coal the enormous figure 7,500,000,000,000. As a cubic yard of coal weighs nearly a ton, we may say that there are in round numbers seven billions of tons of coal available for the use of the human race. If we took the average number of human beings living at each moment during the next 3,500 years to be 2,000,000,000, and the annual consumption for all purposes to be at the average rate of one ton per human being, the supply would last for that enormous period.

But let us consider what portion of this vast supply falls to the share of this country—not including, of course, those coal-fields which lie in countries forming British territory, but not forming part of the British Isles; and let us compare our store of coals with our present rate of consumption and with the probable rate of consumption during coming years.

Some difficulty arises at the outset in determining what portion of the coal-fields actually existing in the British Isles may be regarded as available. We might, indeed, render the question more complicated by setting as a necessary part of the inquiry the determination of the actual

expense per ton for mining, carriage, and so on, according as different parts of the coal-fields were being worked. But for obvious reasons this would not be the place for dealing with the subject in so general or so complete a manner. The sole point I shall here touch on, as bearing on the availability of the various coal-stores, is the probable depth to which coal-mining operations can be pushed.

It was held by many, in 1860–64,* that the coal-mines might be worked to a depth far exceeding the greatest which had then been reached. "The difficulties in the way of deep mining," wrote Mr. Leonard Lemoran, Surveyor of Mines, "are mere questions of cost. It is important to notice that the assumption of 4,000 feet as the greatest depth to which coal can be worked, on account of the increase of temperature is purely voluntary. The increase has been calculated at a rate for which there is no authority; and while we are saying our coal-beds cannot be worked below 4,000 ft., a colliery in Belgium has nearly approached that depth, and no inconvenience is experienced by the miners." But, unfortunately, this sanguine view has not been supported by recent researches. It will be known to our readers that in 1865 Commissioners were appointed for discussing the whole subject of our coal supply. Among their ranks were several of the most eminent geologists, as well as some of the highest authorities on the practical questions involved in the subject. The question of the possible depth to which our mines could be worked was necessarily one to which the Commissioners were bound to give very close attention; and we may fairly accept the result of their inquiries as representing the most trustworthy conclusion which has yet been reached on this particular point. Now, they stated that, according to the ordinary method of working, the depth at which the temperature of the mine would reach blood-heat (or 98° Fahr.) is about 3,000 ft. They expressed a belief that, by the "long-wall" system of working, a depth of 3,420 ft. might be reached before this temperature was attained; but whether this will prove to be the case or not remains to be seen. Now, although the human frame can bear for a while a greater heat than 100° or even 200° Fahr.,† yet it would be impossible to carry on such labours as are required in coal-mining, at a higher temperature than blood-heat, without great suffering and the loss of many lives.

Accordingly, although before the Commissioners began their labours, the total quantity of available coal in Great Britain was reckoned at 200,000,000,000 of tons, it is now generally admitted that, so far as known coal-fields are concerned, the quantity probably available must be reckoned at something less than 150,000,000 000 of tons. The Commissioners themselves found that in 1871 he had "an aggregate of 146,480,000,000 of tons, which may be reasonably expected to be available for use."

It will be observed that this quantity is about a forty-eighth part of the quantity probably available throughout the whole world; so that Great Britain possesses for her area a singularly large supply of the mineral.

Yet the consumption of coals in this country is so enormous that, although we are thus exceptionally well supplied, statisticians have already begun to look with anxiety upon the rapid exhaustion of our stores.

* This essay, as originally written, appeared in 1872, but it has, of course, been modified considerably.

† Brewster mentions that Chantrey's workmen used to enter the furnace which the sculptor employed in drying his moulds when the temperature was as high as 340°, "walking over the floor with wooden clogs, which are, of course, charred on the surface." Chantrey himself and five or six friends stayed for two minutes in the furnace, bringing out a thermometer which stood at 320°.

The questions at issue are exceedingly simple. Let it be granted that our total available supply amounts to 150,000,000,000 of tons. Then at the rate of consumption in 1872, amounting nearly to 120,000,000 tons per annum, this supply would last the nation 1,250 years. But large as our consumption is, it is not the actual rate which is alarming, but the annual increase of rate. Year by year our consumption is increasing. In 1860-64 it was under 84,000,000 tons, and the average rate of increase during the next ten years was more than 3,500,000 tons. Taking it at only 3,000,000, the supply, as estimated in 1872, would not last 280 years. For the increase at the supposed rate would, in 280 years, be no less than 840,000,000 tons, making a total annual consumption of 960,000,000. The mean between this and the rate in 1872 amounted to 540,000,000; and it will be found that 280 times 540 is greater than 150,000.

But startling as is the theory that our coal-supply will be completely exhausted in less than 270 years from 1884—a period corresponding to that between the commencements of the reigns of Elizabeth and our present Queen—there are those who entertain an even more disheartening view. According to them it is not even the rate of increase of the annual consumption which forms the most threatening feature of the case, but the rapidity with which this rate of increase is itself increasing.

Thus Mr. Hull, dealing with the coal supply as I have just done, took 1,500,000 tons for the average annual increase (admittedly, however, a low estimate). We have seen that the average annual increase ten or twelve years ago could not be set at less than 3,500,000. How, if in twenty years the average annual increase should have risen to 5,000,000? in half a century later to 10,000,000? and so on. It is clear, at least, that if changes such as these take place in the *rate* of increase, we have greatly overestimated in the above calculations the probable duration of our coal-supply.

Mr. Stanley Jevons, in discussing the subject in 1863, took the increase of increase into account with very startling results. He said: "We, of course, regard not the average annual arithmetical increase of coal consumption, but the average rate per cent. of increase, which is found by computation to be 3·26." Now, to illustrate the difference between this method and the other, we shall not take the actual figures, which are inconvenient for ready computation. Instead of doing so, we shall compare two simple progressions. One is the series 100, 110, 120, 130, 140, 150, and so on, increasing by ten at each step; the other is a progression increasing at the rate of ten per cent., and runs thus:—100, 110, 121, 133 (not counting fractions), 146, 161, and so on. It will be observed that the corresponding terms of the two series differ more and more from each other as we proceed: the difference is but one at the third term, and amounts to eleven at the sixth. It will be found to increase marvellously with a few more steps. Now, the difference between Mr. Stanley Jevons' method and Mr. Hull's is precisely analogous; only that whereas the rate per cent. just considered is *ten*, it is in the actual case about three and a quarter.

The fact really is, that the rate of increase corresponds precisely, in one case, to that of a capital of 120,000,000 sterling, increased each year by simple interest at the rate of $3\frac{1}{4}$ per cent., while, in Mr. Jevons' method of calculation, the increase is as that of a capital of 120,000,000 sterling, increased by compound interest at the rate of $3\frac{1}{4}$ per cent. per annum. To give an idea of the actual difference as respects the consumption at some distant epoch, let us take the year 1950. Then, according to the former

method of viewing the matter, the consumption in that year will be 373½ millions of tons; according to the latter, the consumption would be no less than 1,446 millions.

Startling as this result may seem, the commissioners found that in the last year of the five during which their labours continued, the consumption corresponded much more closely with the anticipations of Mr. Jevons than with the theory of an arithmetical rate of interest. And they remarked thereon that, though "every hypothesis must be speculative, it is certain that, if the present rate of increase in the consumption of coal be indefinitely continued, even in an approximate degree, the progress towards the exhaustion of our coal will be very rapid."

This will readily be believed when we mention that, according to Mr. Jevons' method of calculation, adopting 3·26 as the rate per cent. of increase, 150,000,000,000 of tons as the total available supply of coal, and 120,000,000 as the present annual consumption, our coals would not last us quite 127 years from 1872.

I venture, however, to indicate reasons for believing that the rate of increase here contemplated cannot possibly continue during many years, and that even the assumption of an arithmetical rate of increase at the present mean rate over-estimates the annual consumption for any time far removed from the present.

*(To be continued.)*

## THE ENTOMOLOGY OF A POND.

By E. A. Butler.

### ABOVE THE SURFACE.

THOSE insects that make their home *in* the pond in their early life only, when fully grown still haunt the neighbourhood, never straying far from the scene of their juvenile associations. Their movements will, of course, be very largely determined by the functions they have to perform. Those whose only business it is to found new families, and which so thoroughly devote themselves to this work as to have but little thought about their own sustenance, will evidently have no temptation to leave the arena of their family labours, but will hover about close to the pond till they have fulfilled their task, and then, after but a brief stage of enjoyment in the performance of parental duties, either die of old age, or more probably fall victims to the voracious appetites of predatory insects, or of insectivorous birds or fish. Such as these will either be found executing merry dances just above the surface, lurking amongst the rank vegetation that fringes the banks, or resting on overhanging trees, from which positions they may easily be dislodged by disturbing their place of retreat. But those that are destined for a longer existence, and so have to make vigorous onslaught upon nature on their own account, as well as to give birth to new generations, will often take foraging excursions into neighbouring woods and fields, though the procreative instinct will with them, too, suggest a speedy return to the water which is to be the nursery of their expected brood.

Coming under the former category are first the *Ephemeridæ*, or May-flies, whose larvæ formed the subject of part of our last paper. There is no mistaking a May-fly (Fig. 1). A most fragile creature, with four membranous and reticulated wings, of which the hinder pair are very much smaller than the others, and sometimes, indeed, absent altogether, with two or three long filaments at the tail generally much longer than the insect itself, and with the organs of the mouth in the most rudimentary condition possible—such is the insect that, in consequence of the sudden appearance and the as sudden disappearance of its myriad swarms, and the extraordinary brevity of its adult life, has attracted popular attention from the times of Greeks and Romans, to the present day, and has, more often than almost any other insect, been used to point a moral to human kind. The name Ephemeridæ, a Greek word meaning living *for a day*, indicates what is usually considered to be the extreme duration of their perfect existence. In captivity they have, it is true, been kept alive for upwards of a week; indeed Stephens reports having kept one for more than three weeks; but there is no doubt that, in a natural condition, this longevity would not have been attained, and in the majority of cases the perfect existence seems to last little more than a few hours. They have no power whatever of taking food, and are utterly defenceless, so that they have no chance of holding their own against the numerous foes that with hungry eyes are looking longingly upon them. Their sole business is to become mated and lay their eggs, and this exhausts all their energies. The antennæ are extremely short, but, as if to counterbalance this, the forelegs are sometimes extraordinarily long. The wings have a number of nervures running longitudinally at short intervals, and the spaces between

Fig. 1.

them are divided into tiny quadrilateral figures by numbers of short transverse nervures, so that the whole surface of the wing is composed of minute enclosed areas which are largest in the centre and smallest at the outer edge. Several species of these insects are known to inhabit the British Isles, but their preservation is a matter of considerable difficulty. Their texture is so fragile that such parts of the body as are of most importance in the separation of the species shrivel up to mere shapeless masses after death, if they are simply allowed to dry as is usually done with insects. A collection of them, therefore, is of but little value to a systematist unless they are preserved in spirit into which they have been plunged when fresh and soft.

They are remarkably regular in their times of appearance, and immense swarms arrive at maturity at almost the same instant, and few phenomena have excited more admiration and wonder than the sudden appearance of myriads of these insects where a few moments before not one was to be seen, and where their presence would be hardly likely to be expected; for, owing to their mud-loving propensities, they are seldom noticed during their long larva- and pupa-hood, and thousands may be close at hand without anyone except those who specially search for them being any the wiser. To the naturalists of a century and a half ago, coming fresh to the observation of nature at first hand, when, as yet there was but the most scanty literature on the subject, the sudden appearance of these gigantic swarms was matter of such intense interest, excitement, and delight, as in these more matter-of-fact days of ours, with the charm of novelty destroyed by an abundant literature, can scarcely be credited,

and it is delightfully refreshing to place oneself for a time in communication with these great spirits of old and try to see things with the eyes with which they saw them. The renowned French naturalist, Réaumur, gives a most minute and graphic account of the first swarm of May-flies he witnessed, and the details are so remarkable that they are worthy of recapitulation, if for the thousandth time. It was in the year 1738 that the experience occurred to him. His garden was situated on the banks of the Marne, and on August 19 a fisherman informed him that on the previous day the flies had begun to appear along the river; or, as he expressed it, the "manna had begun to fall"—a metaphor commonly used to express the advent of the swarms. The illustrious naturalist, therefore, being determined to have a near view of the hatching of the creatures, got into a boat about three hours before sunset, and, proceeding down the river, detached from the banks great masses of earth which contained abundance of pupæ, transferring them to a tub of water he had taken with him. Having stayed out till about eight o'clock, intently watching both banks and tub, but without seeing very many flies, he bethought him that, as a storm seemed to be brewing, terra firma would be preferable to an open boat. He therefore landed, and had the tub conveyed into his garden. But just at this moment the insects began to emerge from the tub in vast numbers, crowding up from the water on to every exposed piece of earth, in order to shed their skins and put on their wings. The scene must have been a most entertaining one; but, in the midst of it all, the rain came on so severely that the observer, ardent as he was, was obliged to beat a retreat, not, however, before covering up the tub with a cloth, that he might not lose his precious insects. The storm soon abated, and he again visited the tub, when he found the crowd of insects much increased, many of them having been drowned through their inability to find sufficient standing room under the cloth. By this time it was quite dark, so that the observations had to be conducted by torchlight; but the light proved a strong attraction to the multitudes of flies that were now emerging from the river, and they flocked round in such numbers that they soon completely covered the cloth which had again been thrown over the tub, and might even have been taken up in handfuls. The delighted naturalist and his attendants now made their way to the river, and here the spectacle was far more astonishing, for, as he says, "the myriads of ephemeræ which filled the air over the current of the river and over the bank on which I stood are neither to be expressed nor conceived. When the snow falls with the largest flakes, and with least interval between them, the air is not so full of them as that which surrounded me was full of ephemeræ. Scarcely had I remained in one place a few minutes, when the step on which I stood was quite concealed with a layer of them from two to four inches in depth. Many times I was obliged to abandon my station, not being able to bear the shower of ephemeræ, which, falling with an obliquity less constant than that of an ordinary shower, struck continually, and in a manner extremely uncomfortable, every part of my face. Eyes, mouth, and nostrils were filled with them." Multitudes, of course, were drowned, but as fast as the stream carried them away, new ones were ready to take their place. The swarms continually increased in density till between 9 and 9.30, when they reached their maximum; but in the succeeding half-hour their numbers rapidly diminished, and by ten o'clock the marvellous spectacle had completely vanished; the vast hosts that had filled the air so short a time before, having fulfilled their destiny, were now numbered with the dead. Other batches came forth some nights afterwards, but not again in such enormous numbers. The fishermen reckon three successive days for the greatest "fall of the manna," and during this time, of course, the fish hold a grand carnival, gorging themselves on the delicate morsels as they fall into the river.

It is remarkable that in Ceylon there is a species of May-fly the abdomen of which is luminous—sufficiently so, indeed, to enable one to capture the insect, even on a very dark night.

(*To be continued.*)

## OTHER WORLDS THAN OURS.

### A WEEK'S CONVERSATION ON THE PLURALITY OF WORLDS.

By Mons. de Fontenelle.

WITH NOTES BY RICHARD A. PROCTOR.

### THE THIRD EVENING.—PARTICULARS OF THE WORLD IN THE MOON, AND PROOFS OF THE OTHER PLANETS BEING HABITABLE.

(*Continued from p.* 301.)

"I SHOULD rejoice," says the Marchioness, "at a wreck of these lunar folks, as much as my neighbours on the coast of Sussex. How pleasant would it be to see 'em lie scattered on the ground, where we might consider at our ease their extraordinary figures."

"But what," said I, "if they should swim on the outward surface of our air, and be as curious to see us, as you are to see them; should they angle or cast a net for us as for so many fishes, would that please you?"

"Why not," said the Marchioness, smiling. "For my part, I would go into their nets of my own accord, were it but for the pleasure of seeing such strange fishermen."

"You would be very sick," said I, "when you were drawn to the top of our air; for there is no respiration in all its extent, as may be seen on the tops of some very high mountains; and I admire, that they who have the folly to believe that fairies, whom they allow to be corporeal, and to inhabit the most pure and refin'd air, do not tell us that the reason why they give us such short and seldom visits is, that there are very few among them that can dive; and those that can, if it be possible to get through the thick air where we are, cannot stay half so long in it as one of your diving fowls can in the water. Here, then, are natural barricades, which defend the passage out of our world as well as the entry into that of the moon; so that, since we can only guess at that world, let us fancy all we can of it. For example, I will suppose that we may there see the firmament, the sun, and the stars of another colour than what they are here. All these appear to us thro' a kind of natural opticks, which change and alter the objects. These spectacles, as we may call 'em, are our air, mix'd as it is with vapours and exhalations, and which does not extend itself very high. Some of our modern philosophers pretend of itself it is blue, as well as the water of the sea, and that this colour neither appears in the one nor in the other but at a great depth. The firmament, say they, where the fix'd stars are placed, has no peculiar light of its own, and by consequence must appear black, but we see it through the air, which is blue, and therefore it appears to us blue; which, if so, the beams of the sun and stars cannot pass thro' the air without being ting'd a little with its colour, and losing as much of their

own. Yet, were the air of no colour, it is very certain that through a great mist the light of a flambeau at some distance appears reddish, tho' it be not its true natural colour. Our air is nothing but a great mist, which changes the true colour of the sky, sun, and stars; it belongs only to the celestial matter to bring us the light and colours as they really are in all their purity; so that, since the air of the moon is of another nature than our air, or is diversified by another colour, or at least is another kind of mist, which varies the colours of the celestial bodies. In short, as to the people of the moon, their spectacles thro' which they see everything are changed."

"If it be so," said the Marchioness, "I prefer this abode before that of the moon, for I cannot believe the celestial colours are so well suited as they are here. For instance, if you put green stars on a red sky, they cannot be so agreeable as stars of gold on an azure firmament."

"To hear you, one would imagine, madam," said I, "you were chusing a petticoat or a suit of knots; but, believe me, nature does not want fancy. Leave it to her to chuse colours for the moon, and I'll engage they shall be well sorted. She will not fail to vary the prospect of the universe, at every different point of sight, and always the alteration shall be very agreeable."

"I know very well," said the Marchioness, "her skill in this point; she is not at the charge of changing the objects, but only the spectacles, and has the credit of this great variety without being at any expense: with a blue air she gives us a blue firmament; and perhaps with a red air she gives to the inhabitants of the moon a red firmament, and yet still it is but the same firmament, nay, I am of opinion she has plac'd a sort of spectacles in our imagination, thro' which we see all things, and which to every particular man change the objects. Alexander look'd on the earth as a fit place to establish a great empire; it seem'd to Celadon a proper residence for Astræa, and it appear'd to a philosopher a great planet in the heavens cover'd with fools. I do not believe the sights vary more between the earth and the moon than they do between one man's fancy and another's."

"This change in our imaginations," says I, "is very surprising; for they are still the same objects, tho' they appear different; when in the moon, we may see other objects we do not see here, or at least not see all there we do see here. Perhaps in that country they know nothing of the dawn and the twilight, before the sun rises and after the sun sets: the air which encompasses, and is elevated above us, receives the rays, so that they cannot strike on the earth, and being gross, stops some of them, and sends 'em to us, tho', indeed, they were never naturally design'd us; so that the daybreak and the twilight are a favour which nature bestows on us; they are lights which do not properly belong to us, and which she gives us over and above our due. But in the moon, where apparently the air is more pure, and therefore not so proper to send down the beams it receives from the sun before his rising, and after his setting, they have not that sight of grace (as I may call it) which, growing stronger by degrees, does more agreeably prepare them for the arrival of the sun; and which growing weaker, and diminishing by degrees, does insensibly prepare them for the sun's departure: but they are in a profound darkness, where a curtain (as it were) is drawn all on a sudden, their eyes are immediately dazzled with the whole light of the sun in all its glory and brightness; so, likewise, they are on a sudden surprised with utter darkness, the night and the day have no medium between them, but they fall in a moment from one extreme to the other.

(*To be continued.*)

# ELECTROPLATING.

By W. Slingo.

## XII.—SILVERING SOLUTIONS.

ONE cannot but be struck with the great beauty and variety of the works of art observable in any good electroplater's show-room. Nor can there be any doubt that the discovery and pursuit of the art of depositing silver electrically, has given a considerable impetus to the trade in silvered goods. As an involved consequence of the profit at first made, competition speedily set in, the result being a cheaper article with the maximum amount of tasteful embellishment. At the present moment, the industry has developed into truly gigantic dimensions, tons and tons of silver being utilised in the process.

The beauty of the work produced lends naturally a great charm to the process from an amateur's point of view. Nor are the experiments accompanied by an undue amount of trouble, while with the adoption of fitting precautions, failure is an unlikely result.

The first thing to be done in starting on a small scale is to prepare the solution which is to be placed in the electrolytic bath. Of course, the expense is greater than that involved in the deposition of copper, but it is not so great as to present a serious obstacle even to one of very restricted means. The chief outlay is at the beginning. A solution once made should last a long time in use without seriously deteriorating. The duration is practically governed by the quality of the ingredients. The silver which is deposited on the plated article appears at the expense of the silver plate used as the anode or positive electrode in the bath, because, although the particles of metal cannot be said to traverse the solution, there is, nevertheless, a particle dissolved off the plate for every particle that finds its way from the solution on to the article forming the cathode or negative electrode.

The last few lines render it almost superfluous to say that the silver employed should be of the finest. Impure silver or alloys will not do, but if no other is available, a purifying process must be resorted to. The simplest consists in dissolving the impure metal in nitric acid, adding the alloy grain by grain, until the whole is dissolved. Do not use too much acid, but start first with a very small quantity, and then, should it prove insufficient to dissolve all the metal, add a little more. When the solution is completed, add a little cold water, at the rate of half a pint to an ounce of metal. Then drop in a few pieces of copper, which the acid will take up, setting free the silver. This silver is then precipitated in a pure state on the surface of the copper, just as copper is precipitated on iron, when a piece of that metal is immersed in a sulphate of copper solution. The supernatant liquor which now consists of nitrate of copper, instead of nitrate of silver, mixed with nitrates of the various impurities, is next poured off carefully, and the deposited silver well washed in clean water.

Having procured the pure metal, dissolve, say an ounce of it, little by little, in a mixture consisting of rather more than an equal weight of good nitric acid (specific gravity 1·420) and about a quarter of an ounce of water. A "word to the wise" is, however, necessary here. In the first place, nitric acid is exceedingly corrosive. Coat sleeves and trousers vanish beneath it in a sometimes alarming fashion, and its effect upon a mahogany dining-room table is anything but entertaining, except in the eyes of a young "destroy-all." If it comes into contact with the skin it destroys it, turning it a yellow colour, which only disappears as the skin wears off.

This burning of the skin is accompanied with considerable heat and more or less pain. It is, therefore, necessary to be careful with it, to prevent it spilling. As it is volatile, the bottle containing the acid should be kept stoppered, and, as heat accelerates its evaporation, it should be kept in a cool place. There is, however, no fear of explosion, except with the most powerful acids, more powerful, in fact, than are likely to be procurable. Another point to be borne in mind is, perhaps, more important than either of those hitherto mentioned, and that is, that when a metal is dissolved in nitric acid, fumes of a most unpleasant and somewhat injurious character are evolved.

The merest tyro in chemical manipulation knows that when a metal, such as iron or zinc, is dissolved in sulphuric acid, a sulphate of the metal is formed, and hydrogen gas is liberated. This results from the metal taking the place of the hydrogen in the acid. The exchange is expressed thus—

$$Zn + SO_4H_2 = SO_4Zn + H_2$$

Zinc and sulphuric acid produce sulphate of zinc and hydrogen.

With nitric acid the case is somewhat different. The metal, copper, for instance, first decomposes the acid forming the nitrate. Thus:

$$Cu + 2NO_3H = (NO_3)_2CuO_2 + H_2$$

Copper and nitric acid produce nitrate of copper and hydrogen,

but this hydrogen does not escape, owing to the unstable nature of nitric acid. A further decomposition takes place, in which the hydrogen splits the acid into water and oxide of nitrogen. Thus:

$$3H_2 + 2NO_3H = N_2O_2 + 4OH_2$$

Hydrogen and nitric acid produce nitric oxide and water.

This oxide escapes into the air and combines with an additional quantity of oxygen, forming nitrous anhydride and nitric peroxide, which appear as pungent brownish fumes. They are intensely irritating to the throat and nostrils, and this portion of the experiment should be conducted in a chimney with a good draught, or, failing that in the open-air. In the case of silver, a series of changes takes place similar to the above. The primary reaction of a metal on an acid may be considered identical in all cases, and to consist in the formation of the corresponding salt and hydrogen; the secondary reactions which occur, and which generally consist in the reduction of a further portion of the acid, depend entirely on the nature both of the acid and the metal employed, on the state of concentration of the acid, and on the temperature at which the reaction takes place. Thus, by the action of various metals on nitric acid, we may obtain at will either ammonia, nitrogen, nitrous oxide, nitric oxide, or nitric peroxide.

To return to the nitrate of silver solution, the whole of the silver being dissolved, a gentle heat is applied to drive off any superfluous nitric acid that may remain. The nitrate being evaporated almost to dryness, half a gallon of distilled or (failing that) rain water is then added. A pure nitrate of silver solution results. Ordinary drinking water is not available because of its impurities.

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M. Beetz has made a standard cell, which is a modified form of Latimer Clark's mercurous sulphate cell. It consists of a tube in which a compressed cake of mercurous and zincic sulphates is placed; at one end of the cake the zinc pole is placed, and at the other end the mercury pole. On short-circuiting the following results were obtained:—Five minutes, 1·440 volts; one hour, 1·439 volts; four hours, 1·439 volts; six hours, 1·437 volts; twelve hours, 1·434 volts; forty-eight hours, 1·408 volts. The resistance was 15·700 ohms.

## CHATS ABOUT GEOMETRICAL MEASUREMENT.

By Richard A. Proctor.

*A.* There are few subjects which seem more mysterious to me than the measurement of the lengths of curves, the areas of surfaces bounded by curves, and the determination of the volumes and surfaces of solid figures bounded by curved surfaces. Surely in all such cases you can suggest approximations to the real values, not those values themselves?

*M.* Well, in one sense, all mathematical results are approximations. We cannot even draw a straight line which really corresponds with the definition of a straight line. We are obliged to assume the existence of lines, surfaces, shapes, and so forth, which we cannot actually picture.

*A.* That is not what I mean. I am well content with the geometry of Euclid, which I regard as exact. What I like, indeed, in Euclidean geometry is the exactness of all its methods and results. Now, if I understand rightly what is signified by non-Euclidean geometry, it is a system of approximation to the truth, and not exact, like the geometry of Euclid.

*M.* I think you mistake altogether. What *do* you understand by non-Euclidean geometry?

*A.* Why, geometry dealing with matters outside those on which Euclid enters.

*M.* That is a mistake. The awkward term non-Euclidean geometry is not applied to geometry beyond or outside Euclid's, but to geometry inconsistent with ordinary geometry. Non-Euclidean geometry requires at our very entry into its domain that we should abandon the axioms, nay, the very definitions of Euclidean geometry. A straight line, for instance, in non-Euclidean geometry, by no means "lies evenly between its extreme points."

*A.* I have indeed been mistaken, then, on that point. I certainly want to hear no more about *that* geometry. The kind of geometry I was thinking of is geometry dealing with matters outside those dealt with by Euclid. We do not find in Euclid any reference to limiting values, infinity, vanishing quantities, and other such matters, which—to my mind—make the geometry of approximations (if I may invent an expression) unsatisfactory.

*M.* Are you quite sure of this? I think you are mistaken here also. To turn to the very beginning of his work, how does Euclid define parallel lines?

*A.* H'm—h'm. Well, certainly in a sense he does seem there to introduce the idea of infinity.

*M.* So I think. And does he not introduce the idea of limiting quantities in the twelfth axiom?

*A.* I cannot say that I see what you mean. He says that two lines referred to in the axiom will meet if produced far enough.

*M.* Yes; but he implies that *no matter how small* the deficiency of the "two angles taken together" from two right angles, those two straight lines will meet on that side where the angles are thus less than two right angles. The idea of a limiting value is here obviously introduced.

*A.* I see now what you mean. Let us consider this axiom for a moment. It has little to do, perhaps, with the subject we are upon; but I should like to have your opinion about this troublesome axiom. I suppose you agree with those who consider that is not in reality an axiom?

*M.* Certainly it is no axiom. The converse is demonstrated in the 17th proposition.

*A.* How so?

*M.* In that proposition it is shown that any two angles of a triangle are together less than two right angles. This

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might be put thus: If two straight lines falling upon a third straight line meet, the two inferior angles made by them with that third line, on the side towards which they meet, are together less than two right angles.

*A.* That is obviously the converse of the twelfth so-called axiom. And the 32nd proposition may obviously be regarded as proving *by how much* the two inferior angles fall short of two right angles—viz., by the angle at which the two straight lines are inclined to each other. But how could all this be corrected?

*M.* It is manifestly an incongruity to have definitions which imply propositions, and propositions which are the converse of axioms; and it is always undesirable to increase the number of axioms. It appears to me that the number of simple propositions should rather have been increased. After all, the ideas underlying the definition of parallel lines and axiom twelfth are simple enough. By accepting as admissible the definition of a right angle (for clearly there must be *some* position in which the angles on either side of the finite line are equal), and the axiom that two straight lines cannot enclose a space as really axiomatic, we can arrive, I think, at both the definition of parallel straight lines and at the proposition involved in the twelfth axiom, without any difficulty—without even assuming that new axiom which Simson proposed. Through a given point only one parallel can be drawn to a given straight line.

*A.* How would you do this?

*M.* I would define parallel straight lines as straight lines at right angles to the same straight line; and I would prove their fundamental property thus:—Let A B (Fig. 1)

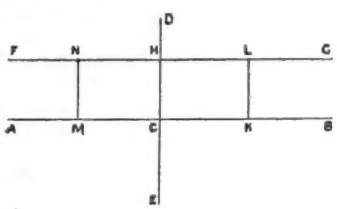



Fig. 1.

be a straight line, D C E a line at right angles to A B; and suppose that on A B, D C E lines have been superposed in the same way that a triangle is supposed to be superposed on another in the fourth proposition of the first book. Now suppose the superposed lines shifted, so that while the line superposed on D C E still coincides with this line, the line superposed in A C B is shifted to some other position as F H G. Then, when we note the equality of the angles F H D, D H G, A C D, D C B, we see that any line of reasoning by which it could be proved that H G, C B meet if produced towards G, B, would equally prove that these same lines meet if produced towards F, A. (We see this at once if we suppose the whole figure turned round H E as an axis till H F comes to the position H G, and C A to the position C B.) Hence if F G and A B, produced both ways, meet at all, they meet both towards F A, and towards G B, and so enclose a space. But two straight lines cannot enclose a space. Hence F G and A B do not meet, however far they may be produced both ways.

*A.* Does not this demonstration indicate also some properties of parallels?

*M.* It indicates several, among others the equidistance of parallels. Thus suppose the points K and M on A B carried to L and N by the shifting motion described, it is evident that K L = C H = M N.

*A.* And how would you deal with the present twelfth axiom?

*M.* Somewhat in this way. (I do not enter fully into these matters because you really want information on a different subject.) The lines D H E, A C B, F H G, Fig. 2, being the same as in Fig. 1, let K H L be any straight line falling within the angle C H G, (so that the angles H C B and C H L are together less than two right angles). Then if we take any point L on K H L, and make L M = H L = M N = N O, &c., and draw perps. L G, M P, N Q, O R, &c., to H R, it can be readily shown that M P = 2 L G, N Q = 3 L G, O R = 4 L G and so on. Hence, however

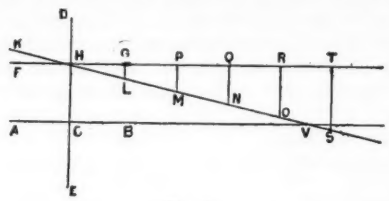



Fig. 2.

small L G may be, we must at last arrive in this way at a distance—as S T, greater than H C, or such that S lies on the side of A C B remote from F H G. Hence at some point—as V—between H and S the line H S must intersect the line A B produced. This *proves* what Simson wanted as an axiom,—that through the same point H there cannot be two straight lines H T and H M, both parallel to another straight line A B. Then, as Simson showed, we can deduce the 12th axiom as the general proposition of which the above is a special case. But you will find all that you need on that point in the Notes to Todhunter's School Euclid.

*A.* Let me see; how did we get upon this subject of the 12th axiom?

*M.* It is a case of a limiting value. The axiom asserts, and as we have seen, it may be proved, that, no matter how small the angle by which the "two angles taken together" fall short of two right angles, the lines will meet if produced far enough. Now in all the problems we shall have to consider, if we are to discuss the subject you have suggested, we have in fact to infer the *exact* value of some curve, surface, volume, or the like by showing that such value does not differ from that definite value by any quantity that can be assigned,—however small.

*A.* Before we leave this question of Euclid's manner, may I ask whether he ever directly uses the method of limits. I see that he indirectly does so in the twelfth axiom.

*M.* He uses it in showing that a straight line at right angles to a diameter of a circle, through its extremity, is a tangent to the circle. For there he shows in effect that no matter how near a point be taken on the circumference, to the point through which the perpendicular is drawn, the line joining the two points is *not* at right angles to the diameter: we only get the right angle when the second point actually *merges into* the first.

*A.* Still, that is not the way Euclid puts it.

*M.* True. But in the twelfth book (which I should like to see much more read than it is) Euclid definitely adopts the method of limits, both in proving that circles are to each other as the squares, and that spheres are to each other as the cubes, of their diameters. His method is as follows: If a sphere (for example) does not bear to another sphere the ratio of the cube of the diameter of the first to the cube of the diameter of the second, then must the first sphere bear this ratio to another sphere differing from the second,

—say, smaller than it. Now let this other or third sphere, and the second, be supposed concentric, the second being the outermost. Euclid shows then (in his spider-web problem, which no one now ever seems to read) that there may be enclosed within the outer sphere a polyhedron (call it $P_2$) not touching or cutting the inner one. Let a similar polyhedron be enclosed within the first sphere, and call this polyhedron $P_1$. Then if $S_1$, $S_2$, $S_3$ be the volumes, and $D_1$, $D_2$, and $D_3$ be the diameters of the three spheres, we have, from an already established property of polyhedra,

$$P_1 : P_2 :: D_1^3 : D_2^3$$

But $S_1 : S_3 :: D_1^3 : D_2^3$, by our hypothesis:

$\therefore$ $S_1 : S_3 :: P_1 : P_2$

or $S_1 : P_1 :: S_3 : P_2$

But $S_1$ is greater than the enclosed polyhedron $P_1$; therefore $S_3$ is greater than $P_2$, or a sphere is greater than a polyhedron within which it wholly lies: which is absurd. Hence the sphere $S_1$ bears to the sphere $S_2$ the same ratio which the cube of the diameter $D_1$ bears to the cube of the diameter $D_2$.

*A.* Ah! Thanks. I think I follow you. But I hope the demonstrations of arc-lengths, surfaces, volumes, &c., will be simpler.

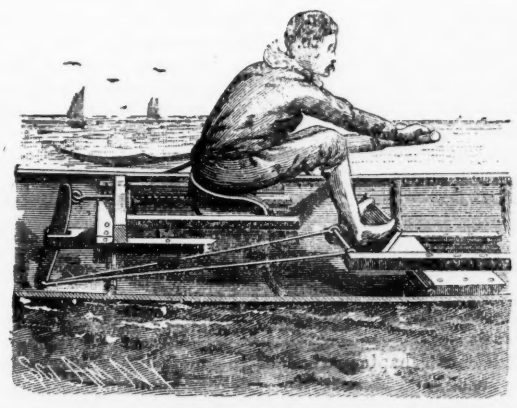
*M.* Nay, if you have followed me at all attentively, the proof is simplicity itself. However, the demonstrations we have now to consider will be direct instead of indirect, and simplified by the introduction of certain considerations not noted by Euclid. They will also, of course, be properly illustrated. Next time we meet we will enter upon them.

*A.* Willingly.

*(To be continued.)*

## SEAT AND FOOT-BOARD FOR ROWING-BOATS.

THE sliding-seat of the usual construction slides between two tracks held on a suitable frame. From the back of the seat projects a rod whose rear end is pivoted to the upper end of an upright lever pivoted to a bar projecting



from the rear of the frame. A spiral spring, surrounding the bar, is held between the rear of the seat and a cross-piece. The foot-board is secured to a cross-piece sliding in longitudinal grooves formed in plates in the boat. The lower end of the lever is connected by rods with the foot-board. The pressure of the spring can be varied by a collar on the rod back of the seat.

When the oarsman makes a stroke, the seat is moved back and the spring is compressed, and the rod is moved in the same direction, when, by means of the lever, the foot-board is moved in the opposite direction. As the oarsman recovers, the spring expands, and pushes the seat back, while the foot-board is drawn forward, thereby relieving the oarsman of the necessity of pulling back the seat, and enabling him to expend all his force and power on the stroke. The recovery being very rapid, fast rowing is admissible.

This invention has, says the *Scientific American*, been patented by Mr. James J. Turpel, of Halifax, Novo Scotia.

## HOW TO RIDE A TRICYCLE.

By John Browning,

*Chairman of the London Tricycle Club.*

HOW to ride a tricycle *easily*, that is what I mean. In the early spring of this glorious summer, I was walking with my wife on the esplanade at Brighton, and looking towards Hove I saw a gentleman riding towards us on a rear-steering tricycle. His legs were going up and down like the beams of an engine, and his shoulders were working as hard as his legs. He was an immensely powerful man, standing little, if anything, short of 6 ft. in height, and weighing about 16 st. I said to my wife "He will tear that machine to pieces before long," but I had little idea how soon my prediction would be fulfilled, for within a minute of the words being spoken, he fell off the machine, and, on going to his assistance, I found that he had torn the iron seat off the spring. Part of the metal-plate had given way, the bolts were wrenched off, and one of the strong metal straps had broken. Yet, with all the strength he was exerting, he was not travelling at more than six miles an hour. Had the same amount of strength been skilfully applied, it would have urged him along at the rate of twelve miles an hour, at least. I have never before or since seen so bad a rider; but there are very few riders who apply their strength to the best advantage, and obtain the speed they should get in proportion to the work they are doing.

Many riders have complained to me that, while they can ride eight or nine miles in one hour, they cannot, without great difficulty, ride more than about forty miles in a day. Should they be possessed only of the most moderate staying power, if they will act on the following hints they will soon find the distance they can travel greatly increased. They will then know that they have tired so soon because they have not studied how to ride easily:—

First, I would recommend all those who wish to thoroughly enjoy riding, and to obtain the utmost benefit to their health from the exercise, to restrict their pace to about five or six miles an hour on a Sociable, or six to seven miles an hour on a single machine, and the distance they ride to from thirty to forty miles in a day on a Sociable, and from forty miles to fifty miles in a day on a single machine.

I have known of two or three cases of people giving up riding, after a very short experience, because they found that they could not ride at the rate of nine or ten miles an hour "for even half a day." They had been misled into believing that this would be easy work for them. Apparently it had never occurred to them that, as they would have to climb up many hills, and travel over rough roads, and, at times, drive against the wind, their pace would

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often be reduced to between five and six miles an hour, and that, therefore, to drive at the rate continuously of nine or ten miles an hour they must, to compensate for this reduced speed, make a pace a great part of the way of from twelve to fifteen miles an hour, and this although they were only novices in riding.

Nothing in my experience hinders a novice in his progress to good riding so much as trying at once to ride very fast. Let him strive only to ride *as easily as possible*, and, after a time, if he rides a good machine, the pace will come without proportionately increased exertion.

Even if you intend to ride quickly, never start quickly; do not start at more than five or six miles an-hour for the first few miles, particularly if you start directly after breakfast, and purpose riding for the whole day.

As I have mentioned rough roads, let me say at once that the way to ride those as easily as possible is to have good large rubber tyres on your wheels. No tyres should be used less than $\frac{3}{4}$ of an inch in diameter for the driving-wheels of single machines, and $\frac{7}{8}$ths are better. The small wheels should have tyres $\frac{1}{8}$th larger than those on the driving-wheels. The rubber tyres of the Sociables should be $\frac{1}{8}$th larger than the sizes I have recommended for single machines.

Large tyres will be found advantageous in many ways; they will not be nearly so liable to come off as small tyres, and they will not be cut to anything like the same extent by sharp stones. Their durability will, therefore, be found very great.

Mud is, of course, a great obstacle to easy riding. I have only one hint to give in connection with it. If the mud is stiff—not slushy—ride where the mud is the wettest. I constantly see people riding on the driest part of the road under these circumstances, where the work is twice as hard.

Hill-riding is, of course, hard work; but practice and skill in time make it comparatively easy.

Two-speed gearings are the greatest boon to those who wish to ride easily. My advice is, never ride any machine without one. In former articles I have described those I consider the best.

If you wish to ride without fatigue, *never pull at your handles*. Whenever you are on rising ground, or working through mud, or over loose stones, or against wind, lean well forward, resting on your handles, instead of pulling at them. This position has the great advantage for hill-riding that there is no fear of the machine capsizing backwards; and for making progress against the wind it is the best, because it diminishes considerably the surface of the body presented to the wind.

Whenever you find that leaning forward does not give sufficient power, rise from your seat or saddle and stand on your pedals, if you have not far to go under such difficulty; but if you have, dismount at once, for you will find pushing the machine much easier than riding, and the change of motion acts as a rest.

In dismounting on a steep hill, do not trust to your break, as there are very few breaks which will stop a machine when it is running backwards. Lean well forward and stop by pedalling forwards if it commences to run backwards, steering at the same time, so that the tricycle will turn straight across the hill.

Clutches are a great assistance to easy riding, and help a rider considerably in surmounting short, steep hills, especially if there is a short, steep down-hill before coming to them.

When the machine has a clutch, or clutches, the feet can be held still at any time and the pedals act as foot-rests. In running down a slight incline, the pedals may be driven quickly at intervals, and the machine may be made to travel at a good pace, and yet the rider may rest himself the greater part of the time.

An illustration will best show the use of the clutch. Riding one morning near Croydon, a tricyclist overtook me and passed me, evidently using some exertion to do so.

I have made it a rule never to race with any one, so I did not quicken my pace, but after a time I came up with the rider at the top of a steep hill; having a clutch on my machine, I pedalled very quickly just at the top of the hill, then held my feet still until I was three-quarters of the way down, and at this point pedalled again quickly, and rode all the way up the opposite hill without difficulty, probably at the rate of seven or eight miles an hour. I could not with safety have taken my feet off my pedals and caught them when rushing down the hill. My antagonist tried to pedal fast down the hill, and missed his pedals, and letting his machine come nearly to a standstill, he came on dead-centres about half way up the hill, and had to dismount and push up the rest of the way, and he did not attempt to pass me again. I doubt if I should have got away from him had it not been for my clutch.

Clutches are invaluable on a Sociable when you are riding with a lady, for it frequently happens that a lady tires quickly, and then, if she cannot pedal as quickly as the gentleman, she actually helps to stop the machine; with a clutch this is impossible.

The last hints I can give here as regards easy riding, are to ride on a saddle well over your cranks, and to use a crank with a short throw. The first Sociable I had was furnished with a crank nearly $6\frac{1}{2}$ in. long; now I am riding with a crank barely 4 in. long. Short cranks are not nearly so tiring as long ones, unless the machine is geared too high. Of course, for working up a steep hill long cranks are the best, but the excessive motion of the legs continuously, to so great an extent, becomes fatiguing. For this reason, using plenty of ankle-play, so as to reduce the rise and fall of the knees, will be found very advantageous. On a future occasion I may write a short article on pedalling, as I cannot at fitting length refer to it here.

If my readers expect me to tell them how to ride fifteen or sixteen miles in an hour, and a hundred miles within ten hours on a right-away, give-and-take road, I am sorry I cannot assist them. Two or three members of my club can do this, and I know half-a-dozen men altogether who can accomplish it; but I doubt if they could help any one else to do it, if they wished to. Their great pace is the result of youth, health, strength, and incessant practice, and coupled with these a determination, whenever they ride at such a rate, to spare neither themselves nor their machines, come what will.

## DICKENS'S STORY LEFT HALF TOLD.

A QUASI-SCIENTIFIC INQUIRY INTO

## THE MYSTERY OF EDWIN DROOD.

By Thomas Foster.

(*Continued from p.* 314.)

THE next chapter is one of the most interesting in the book, and is worthy of Dickens's best days. It contains several points well worth noticing in reference to the development of the plot.

In the first place, we note that Crisparkle has come up "by the very first train to be caught in the morning," so that there is no fear lest Jasper should be in town too, for he must stay for the morning service at Cloisterham. He has consulted with Mr. Grewgious. It is noteworthy, by

the way, how thoroughly Grewgious takes the management of everything at about this time. They all defer to him, and his whole manner shows that he is master of the situation.

A visitor is announced, and Crisparkle, not knowing whom it may be, is for not seeing him. But Grewgious advises that, whoever it may be, he should come in. "It is a business principle of mine," he says, "not to close up any direction, but to keep an eye on every direction that may present itself. I could relate an anecdote in point, but that it would be premature." What is clear from this, is that a time is approaching when Mr. Grewgious will have a good deal to disclose. What is not clear, is the nature of the special experience he refers to. It bears of course on the Drood mystery, or its disclosure could not be spoken of as premature. But, among the scores of things it *might* be, one cannot well guess what it was. Possibly Mr. Grewgious refers to the unexpected use he had found for Bazzard, or perhaps to the events which had suggested the "Datchery assumption." Be this as it may, Mr. Grewgious is obviously preparing for disclosures which will astonish many, and crush Jasper to the ground.

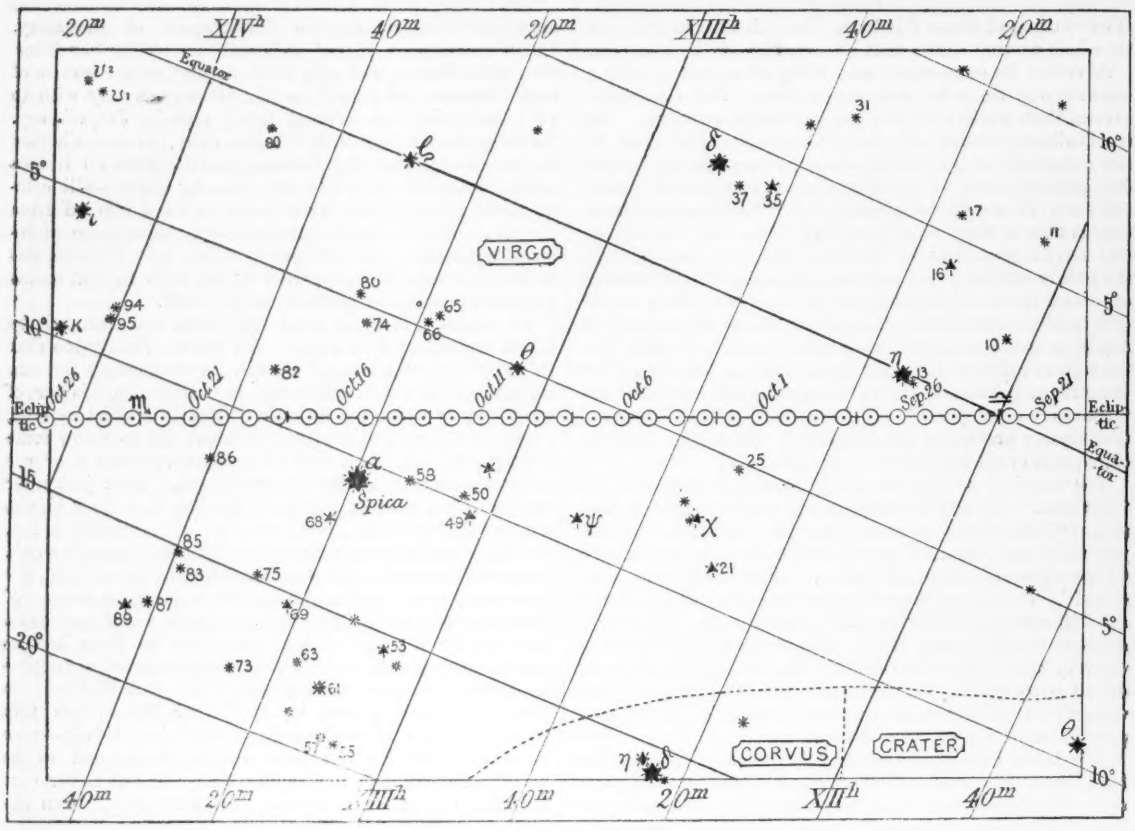
The meeting of Tartar and Crisparkle is a rare bit of "Dickens." So also is the behaviour of Grewgious at this point ("I am proud to make your acquaintance. I hope you didn't take cold. I hope you were not inconvenienced by swallowing too much water. How have you been since?" This is as funny as anything in Pickwick, though not—like so much in Pickwick—overdrawn). Mr. Grewgious presently has an idea. He has seen that Tartar is the very man to help Neville and Helena. He is the very man too to defeat "our local friend" ("on whom I beg to bestow a passing but hearty malediction, with the kind permission of my reverend friend").

We learn here that Grewgious's watch of Neville has led him to suspect, possibly to *know*, that Jasper employs some "hanger-on of Staple" to watch Neville during his own absence at Cloisterham. I am half inclined to imagine —though I must confess I have scarcely any evidence to support the notion—that Grewgious has cleverly arranged matters so that Bazzard has fallen into Jasper's way, and been employed by him on this very service. If Jasper had so met Bazzard, hanging about after his manner, and had suggested such work to him, we can imagine that Grewgious's first idea when he heard of it would have been to tell Bazzard indignantly to reject the proposition; but on second thoughts he might have found here "a direction which had chanced to open," and had applied his business principle of keeping his eye on every direction presenting itself. In such a case that would assuredly have been "an anecdote" very much "in point," but which it would have been premature to relate. And this would have been a detail thoroughly in Dickens's style,—Jasper trusting Bazzard with full knowledge of his own whereabouts (and Grewgious seems better able to follow Jasper's movements than otherwise we could expect), employing him to traduce Neville to Landless, and, in fine, delivering himself up, not knowing what he was doing, to an employé of his enemies. This would be good. But I think I see my way to something better yet, and still more in Dickens's style. What if Bazzard tried to play a double game, something after the manner of Silas Wegg, whom, of all Dickens's characters, he most resembles, and if Grewgious allowed this to go on in such sort that the discomfiture of Bazzard became as interesting a minor feature of the dénouement as the discomfiture of Silas Wegg in the dénouement of "Our Mutual Friend." However, this is necessarily mere guesswork; not, like most of the considerations I have brought foward, a direct result of the analysis of the evidence.

The closing parts of this chapter and the whole of the next bear strongly on the development of the story. Tartar's rooms are placed at Rosa's service for her inter view with Helena, and also, be it noticed, at the service of such "comers and goers" as Mr. Grewgious may wish to visit the Landlesses without being seen by Jasper's spy. Tartar undertakes to visit Neville daily, to see whether Jasper—in his plan for isolating Neville from all friends and wearing his daily life out grain by grain—will communicate in some way with Tartar to warn him off from Neville. We see opportunities here for abundance of interesting matter. Indeed, one wonders how Dickens was to have got into the other half of the work all that seems promised in the later parts of the first half.

Of course, it is made clear that Rosa and Tartar have fallen in love at first sight. We know certainly too that this love is to "end well," though its course may not run smoothly all the way. But even in entering on this part of the story, by which the fortunes of Rosa, the chief heroine, are to be disposed of, Dickens does not fail to throw some sidelight on the main plot of his story, though they are only to be caught by the keener-sighted. Thus just after we have been told, in Dickens's fashion, that Rosa thinks more of Tartar than Edwin were he still affianced to her, (or did he still love her though no longer affianced) would approve (I mean in the words relating to Rosa's hat), the two start, arm in arm, Crisparkle walking in front. If Edwin is dead, or Rosa so supposes, this would not be an occasion for thought of him, especially as Rosa had no reason up to the time of Edwin's disappearance, to suppose he loved her more than others did. But if Edwin is alive and Rosa knows it, if further Edwin has told Grewgious and Grewgious Rosa that he—Edwin—now loves her, but she has been unable to respond as he would wish (though not saying that she can never care for him except as a brother),—this moment, when she is just entering "the country of the magic beanstalk" the dreamland of love, would bring Edwin to her thoughts. As Helena, a little later, recognising Rosa's love for Tartar, "seemed to compassionate somebody"—that somebody being Neville—so Rosa, recognising, though half unconsciously, her nascent love would at the moment compassionate another—that other being Edwin. "'Poor, poor Eddy!' thought Rosa, as they went along." Consider how full of meaning all this is. Dickens was not so poor an artist as to throw in the thought of Edwin's mysterious disappearance, or even his supposed death, at the moment of Rosa's incipient love for Tartar. It is certain that Rosa thinks of another's love, not of another's death, at this moment. She must know, then, that Edwin loves her and—now, for the first time—that his love is hopeless. She must know, therefore, that he is alive. All this corresponds well with what we have already become assured of, and therefore is not new. But it is worthy of notice how Dickens multiplies sidelights for observant readers, and how little he fears lest the careless reader should detect his meaning.

Helena's love for Crisparkle is shown in the second of these two chapters relating to Rosa, Tartar, and Neville Landless. "I could believe any such thing of Mr. Crisparkle," she says, with a mantling face, supposing Rosa to have spoken of Crisparkle saving Tartar's life ("more blushes in the beanstalk country"). We learn from this way of speaking, not only that Helena loves Crisparkle (we already know he loves her), but that their love, like that of the other pair, is to end well. For Neville, then, and for Edwin, we have no such promise. Yet we feel that the end of these two, though both are unfortunate in love, is not to be the same. Neville is to die, Edwin is to remain




Day Sign for the Month.

unmarried. The sympathy of Grewgious for both these young men is in great part due to his own past hopeless love for Rosa's mother.

If the pen had fallen from Dickens's hand just here, all that need have been known to make the drift of the story clear would have been told. We should be certain that Jasper was to be brought to condign punishment, Neville to be cleared though he was to die young, Edwin to become the valued friend of Tartar, Crisparkle, Helena, and Rosa, and these four to enter on that "happy marriage" condition which has been regarded from time immemorial as the appropriate fate of the heroes and heroines of happily-ending novels. We should regret our loss in the absence of those chapters in which the progress of events to this happy end would have been pleasingly narrated. But as to the general nature of the dénouement we could have no manner of doubt.

More, however, was written, and in what was written we have evidence even as to some of the details which would have appeared in the closing chapters.

(*To be continued.*)

Cats at Elevated Stations.—Notwithstanding the affection of cats for the tiles, they do not thrive at great heights. A scientific observer, who has recently tested the matter at a lofty station (12,000 ft. above the sea) on the Wahsatch Mountains, in Utah, finds that cats become subject to fits at such heights. The affection is partly due to the increased action of the heart and lungs, partly to the direct effect of diminished pressure.

## ZODIACAL MAPS.

By Richard A. Proctor.

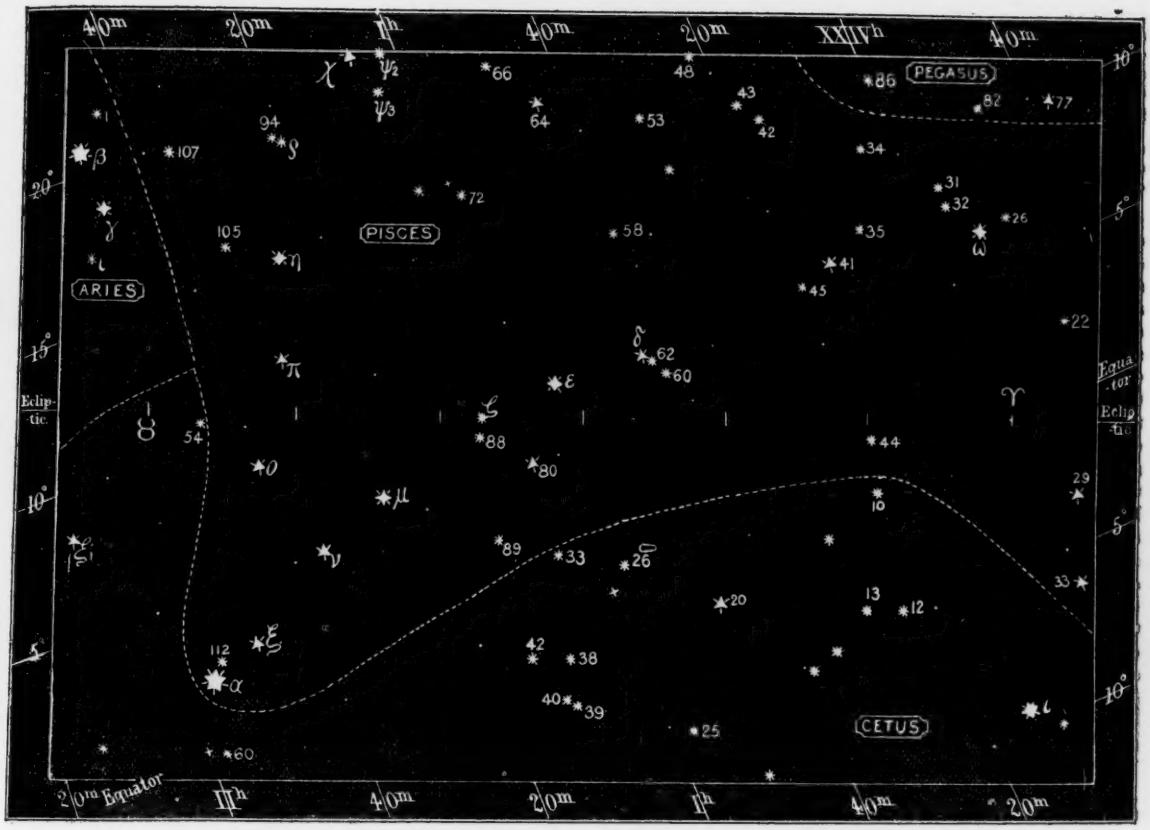
We give this week both the day sign and the night sign for the month, one showing the zodiacal sign now high in the heavens at midnight, the other showing the region of the zodiac athwart which the sun pursues his course at this part of the year.

## THE INTERNATIONAL HEALTH EXHIBITION.

XXI.—ANTISEPTICS AND DISINFECTANTS (*continued*).

In our last communication we gave a brief account of some of the more important inventions which come under the title of our present subject. Their mode of application, in a few instances, calls for the assistance of specially constructed apparatus, and amongst these James Robertshaw's "Improved Disinfecting Tripod" * is noteworthy as a remarkably convenient instrument for the application of sulphurous acid gas in cases where the fumigation of tenements is imperative. The instrument consists of three wooden rods arranged somewhat after the fashion of a photographer's tripod camera-stand. To the summit is affixed a brass rod crowned with a pan-shaped holder for the re-agent, and the entire system is so con-

* Of 3 and 5, Simpson-street, Manchester.




Night Sign for the Month.

structed that the pan may be elevated to a height of about 11 ft., and securely locked, so that it cannot possibly become displaced. The slide, moreover, can be fixed in any desired position by means of a wheel-nut, which works on a screwed taper portion inside the nut; this taper portion of the slide is cut into six divisions, and by screwing the nut down, it causes the taper portion to contract and grip the slide, thereby holding it in any position. An item of the utmost value in the exhibition of sulphurous acid for fumigating purposes is secured by the use of this appliance. It may be raised close to the ceiling of the room with absolute safety, the re-agent may then be ignited, and the fumes will descend, in virtue of their gravity, to do their work of disinfection. We may sum up the advantages to be gained by its use by calling it simple in construction, portable, effective in employment, and free from all the dangers which prevail when sulphurous acid gas is ordinarily used.

Two other fumigating methods of value are those introduced by McDougall Brothers, of 10, Mark-lane. The first of these provides for a generation of carbolised vapour; it consists of a small petroleum oil stove that burns without smell and requires no chimney, but yet suffices to produce the slight heat required for the expulsion of the carbolic vapour. It is designated a germicide.

McDougall's apparatus for the application of sulphurous and carbolic fumes in combination, is worthy of the attention of everybody interested in sanitary reform. He has introduced two methods for the fulfilment of his design. The first consists in the admixture of two powders, termed "McDougall's Disinfecting Powder" and "Acid Powder," respectively; no ignition is required, and the whole process is economical, trustworthy, and free from all dangers. The other plan we do not think quite so good as the foregoing, inasmuch as it requires the use of liquid sulphuric-acid and a powder, the application of which in the hands of servants is apt to become somewhat dangerous; yet, nevertheless, it is an advance on all former methods.

In conclusion, we would direct the attention of our readers to the exhibit of the London Patent Automatic Disinfector Company, of 53, Queen Victoria-street, London, E.C., whose apparatus for the healthy maintenance of soil-pipes in houses deserves more than ordinary mention. Appended we give a quotation from their prospectus:—

> The invention of this automatic apparatus fully supplies a want long felt in every household, however good may be the sanitary arrangement as regards closets and drains; indeed, its advantages must be patent to the most casual observer. The application of the apparatus effectually neutralises and destroys the foul gases, while disinfecting and deodorising all objectionable matter, and not only deodorises, but is a test of the cleanliness of the closet itself, as well as the purity of the water in the cistern; and by copiously flushing the drains with a powerful disinfectant every time the w.c. is used, and always leaving disinfectant remaining in the pan, all germs of disease are destroyed that would otherwise inevitably escape into the house.
>
> The apparatus is applicable to any kind of closet or urinal, is fixed entirely out of sight without disturbing the pipe, the cost of which is £1. 12s. 6d. It will contain sufficient disinfectant for 10,000 gallons of water, which, under ordinary circumstances,

XUM

would be more than sufficient for one year, and can be re-charged in less than five minutes at a cost of 2s. 6d. without disturbing the woodwork of the w.c. It is specially valuable for private houses, hotels, public offices, factories, ships, and railway stations, hospitals, schools, public institutions, &c., for which special prices will be quoted when taken in large numbers.

Carbolic, or any other soluble or liquid disinfectant which may be desired, can be used. It is of the most simple character, cannot possibly get out of order, and, being made of copper and brass, will last for many years.

The importance of the subject of disinfectants and antiseptics to the inhabitants of this vast metropolis and other large communities need not be urged. It is part and parcel of the great sewage question which has of late disturbed us. We are of opinion that an evil of such magnitude cannot be suppressed by extraordinary measures; no discussion in the Houses of Parliament, no voting of large sums of money can be adequate to the wants of the case. We are confident that nought but a careful co-operation of the householders and landlords will avail. If each one would apply himself to the healthy conduct of his abode, to the application of the remedies we have discussed under the head of disinfectants, the annoyance would be abated. Thereafter a gradual process of reform might be introduced in the construction of healthy houses, and we may rest assured that ere long a trustworthy and lasting system of sanitation will be established in our midst.

In our next we shall enter into the details of some of the most valuable advances that have been made with regard to the protection of our homes from filth, infection, and disease.

## "OUR BOYS" IN THE ARENA.

IT has been sagely remarked that "all work and no play makes Jack a dull boy." Now, owing to certain misgivings of our own as to his identity, we are unable to consult the author of this trite remark in the matter, yet we have no hesitation in saying that the applicability of the adage may be extended to boys generally, even though they may not rejoice in the possession of so thoroughly downright a name as Jack. However that may be, the spirit of the proverb has been liberally accepted by the directors of the Polytechnic Institute for Young Men, the aims and objects of which were discussed in an article recently printed in these pages.

We do not propose here to revert at any length to the educational advantages offered to young men by the Institution; the soundness of that portion of the scheme projected by Mr. Quintin Hogg and his coadjutors was sufficiently demonstrated in the article above referred to, and may at present be dismissed with a confirmation of Mr. Slingo's assertion, that the "idea is to foster and promote every feeling, every exercise, every train of thought, which is calculated to help a man in his effort to become a good citizen and an honour to his race."

Our special object is to draw attention to the *social* advantages held out to young men as inducements to them to become members of the Institute; for it appears to us that the ultimate success of the undertaking is to a great extent dependent upon the maintenance of a spirit of *camaraderie* amongst its members. This was readily perceived by Mr. Hogg and his friends, and their untiring efforts have been directed to the formation of various clubs in connection with the Institute, each one of which is calculated to form a strengthening link in the chain of companionship which binds the members to each other. Already there are clubs in full swing for swimming, rowing, cricket, football, lawn-tennis, and bicycling; there is an excellent gymnasium; a Volunteer company has been recruited; and the members of the Institute have also established three bands—brass, drum and fife, and orchestral. Besides these, there are, of course, the usual chess and draught clubs, debating societies, &c.

At the first blush it may perhaps be thought that there are "too many irons in the fire," but this supposition vanishes when we consider that three thousand members are enrolled on the books of the institute. These numbers are quite sufficient to warrant the hope that the clubs will be, to a great extent, self-supporting, and, as a matter of fact, all of them are now in a flourishing condition. It would be strange, too, if this were not the case, considering the munificent help rendered by the patron of the scheme. For instance, a swimming-bath has been provided by Mr. Quintin Hogg at an outlay of £8,000, the same gentleman having also purchased a cricket-field for the members, of such a size that Lord's ground sinks into complete insignificance in comparison with it.

Nor are these athletic and other amusements pursued at the expense of the more serious work. On the contrary, it is manifest that, being properly managed, they can but act as incentives to study. The annals of our Universities afford abundant testimony to the pre-eminence as scholars of those who were foremost in the field and on the river. It can hardly be denied that the activity of the brain is promoted by a healthy condition of the body: and this being so, opportunities for recreation should be doubly welcome to those who are studiously inclined. In short, the importance of physical exercise cannot too strongly be impressed upon the young men of to-day. Then, again, it must not be overlooked that the existence of these clubs is in itself a security for constant attendance at the classes of instruction, simply through the *esprit-de-corps* thereby promoted amongst the members. For these, as well as for other equally important reasons, the value of these branches of the Institute cannot well be over-estimated; and, therefore, we are glad of the opportunity of offering a few words of encouragement to those directly concerned.

A few evenings since we were present, at the Royal Albert Hall, during a performance given by members of the Institute gymnasium, the popularity of which latter is amply testified to by the fact that upwards of sixty members took part in a programme consisting of the usual features—singlestick and dumb-bell exercises, vaulting, horizontal and parallel bars, boxing, fencing, &c. We must say that the proceedings were carried out in a manner highly creditable to all concerned; indeed, it is no exaggeration to assert that some of the items on the programme could not easily have been excelled by professional gymnasts. We were much struck by the smart and picturesque evolutions performed during the "maze," and the vaulting over the "horse" was also very effective. But where all was so well done, it would be invidious to further particularise, so we will content ourselves on this head by acknowledging the evident ability of the gymnasium instructor, Colour-sergeant Barber. As we watched him in the arena, strictly and impartially using his judgment, and witnessed the near approach to perfection displayed by his pupils, we mentally invested him with Artemus Ward's oft-reiterated description of the gentleman in "black close," who brought the skittish Octoroon under his notice; for (having regard, of course, only to his capabilities for his post) Mr. Barber was, to our mind, "apeerently as fine a man as there was ennywhares." We wish the gymnasium and its kindred institutions all success.

No excuse need be offered for presenting these remarks, even to those of our readers who are not personally interrested in the matter; for surely we are merely writing in

furtherance of our motto, "Let knowledge grow from more to more," in thus making widely known the inducements—nay, let us rather say enticements—offered to youths by the Polytechnic Institute to enable them to qualify as valued members of society. Those of our readers, on the other hand, who may desire further particulars, should read, if they have not already done so, the article on the subject which appeared in No. 153 of KNOWLEDGE, or make application to the secretary of the Institute, Mr. Mitchell, who will gladly enrol candidates for admission into the ranks of "Our Boys," as the members are felicitously designated by those who have their welfare at heart.

We cannot, in conclusion, refrain from again insisting on the undoubted advantages offered to young men by Mr. Quintin Hogg and those who assist him in carrying on this great work. No more fruitful or attractive enjoyment can be found for a youth's leisure time than is to be obtained under their auspices; and if he cannot derive tangible advancement from becoming a member of the Polytechnic Institute, where he can obtain for a trifling fee the best possible instruction, technical as well as theoretical, in many departments of study, combined with the comfort to be found in *really* sociable surroundings, then all we can say is, "Jack" must be a very "dull boy" indeed.

## Editorial Gossip.

I HAVE seen with regret that Dr. Kinns, author of a work entitled "Moses and Geology," (which I have not read) has been troubled by remarks which the acting editor made, in all good faith I am well assured, on his lucubrations. In rejecting, however, as utterly inadmissible, the line of reasoning followed by Dr. Kinns, I am quite at one with my friend the acting editor. Dr. Kinns submitted to me, when KNOWLEDGE was as yet very young, the outline of his reasoning, and a most stupendous miscalculation of the probabilities in favour of his particular interpretation of the real meaning of the account of the creation in the first chapter of Genesis. Those who are curious in the matter can find (I cannot) my reply to Dr. Kinns in some of the earlier columns of "Answers to Correspondents." Suffice it that I did not give insertion to reasoning which seemed to me most obviously illogical, and that—probably—the glimpse of his idea which Dr. Kinns then gave me prevented me from even thinking of reading the work which he subsequently brought forth.—R. P.

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I CAN hardly imagine a more serious attack on the account in Genesis, than that which Dr. Kinns has in effect made while seeming to defend it. To suppose the account erroneous in several important respects implies only that, whether inspired or not in matters relating to religion, the writer of the book of Genesis was not inspired in regard to scientific matters; but to suppose the account can really be interpreted as Dr. Kinns suggests, is to suppose that a person (not Moses, whoever he was) inspired with knowledge of all the facts, was so unskilful as a writer that every single reader had misunderstood him till Dr. Kinns came along with his help to clear up the meaning of a divinely-inspired penman. This, of course, is monstrous on the face of it.—R. P.

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BUT while I am thoroughly at one with the gentleman who has kindly acted as editor for me during my absence from England, in rejecting unhesitatingly the argument which runs through Dr. Kinns' work (as I understand), I saw with regret a charge of ignorance brought against Dr. Kinns, and with pleasure its ultimate withdrawal. For my own part, I should feel loth to accuse any one of ignorance, being so thoroughly ignorant myself—in multitudes of special departments of science. Every man living, however well informed he may be in some subjects, is grossly ignorant in a much greater number. I do not even know an astronomer who is not ignorant in some departments of his own subject, nor any chemist, geologist, botanist, entomologist, or other specialist who—if really a master—will not admit that there are departments of his special subject about which he knows very little. How much more ignorant must he be of subjects outside the few he can have made his own.—R. P.

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THE only ignorance which is really contemptible is that crass ignorance which can see no knowledge worth having outside the petty domain which any one man can conquer. It was such folly, not mere ignorance about this or that subject, to which Molière referred in the well-known lines:—

> J'ai cru jusques ici que c'était l'ignorance
> Qui faisait les grands sots, et non pas la science—
> Vous avez cru fort mal; et je vous suis garant
> Qu'un sot savant est sot plus qu'un sot ignorant.
>
> —R. P.

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I HAVE found that even my "Easy Star Lessons" and "The Stars in their Seasons" require to be supplemented by a simpler guide to a knowledge of the heavens. My "Half-Hours with the Stars," originally prepared for my friend Mr. Hardwicke, as a simpler version of my "Constellation Seasons," is rather rough, and not quite simple enough. It was never intended as more than a test of the young student's requirements in that direction. I propose now to bring out fortnightly (or rather twice a month) a series of still simpler star-maps, showing the position of all stars of the first three magnitudes, over the whole heavens for every night in the year. With 24 such maps for the year, the student can always find a map showing the stars as they are actually situate, *within less than half-an hour* of the moment of observation. These maps will thus form a series which might be very correctly called "Half-Hours with the Stars," seeing that if the observer continues his survey on any night in the year for half-an-hour, he will be able to select a map showing the stars precisely as they are at some part or other of that half-hour. The series will be called, however, "First Star-Lessons." The maps will be drawn for the latitude of mid-Britain. They will commence in November, so that if any alterations of plan suggest themselves, the complete series on such improved plan may begin next January. —R. P.

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I HAVE by no means forgotten my promise respecting maps showing the stars with constellation figures. But all things cannot be done at once. I have an immense amount of astronomical mapping to get through before I have completed my proposed work in that direction; but those who follow the progress of KNOWLEDGE patiently will find all done—if I live—in due course.—R. P.

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ERRATA.—In the "Face of the Sky," on p. 303, the times of rising of Saturn are erroneously given. They should really be 8h. 10m. p.m., on October 10, and 7h. 15m. p.m. on the 24th.—Letter 1457, last paragraph, "Whether science will ever directly," read "indirectly."

# Reviews.

## SOME BOOKS ON OUR TABLE.

*The Alpine Winter Cure.* With notes on Davos Platz, Wiesen, St. Moritz, and the Maloja. By A. T. Tucker Wise, M.D., L.R.C.P., M.R.C.S., &c. (London: Baillière, Tindall, & Cox. 1884.)—Within the memory of a very large proportion of the readers of these lines, consumptive patients were invariably dispatched to a warm climate for the relief or cure of the fell disease with which they were attacked. Now the pendulum has swung to the opposite extremity of the arc, and intense dry cold appears to be the latest remedy for phthisis. Dr. Wise's book is a guide to a few winter resorts in the Engadine, and he decides in favour of the Maloja as the most salubrious spot, and that furnished with the greatest number of conveniences and appliances for the patient afflicted with incipient consumption. He gives exhaustive meteorological details in connection with this locality, and explicit directions for getting there. The sufferer from incipient phthisis who is prepared to face an occasional minimum temperature of 7·5 Fah. may consult his little book with advantage.

*In the Watches of the Night.* By Mrs. Horace Dobell. Vol. III. (London: Remington & Co., 1884.)—Since the publication of the second volume of verses, which we reviewed on p. 75, Mrs. Dobell (like the woman in Mark) seems to have "nothing bettered, but rather grown worse." Opening her third volume, as we did its predecessor, absolutely at random, the first words our eyes light upon are these:—

The Blue Moon.

Oh, yellow moon, of whom our poets sang,
Hast thou, then, altered thy fair face of old?
Now as a *cheese* in a *pink* sky to hang;
A *Stilton* cheese—all covered with blue mould.

This may be poetry, but, for the life of us, we cannot discern it.

*The Art of Solving Problems in Higher Arithmetic.* By Rev. J. Hunter, M.A. (London: Longmans, Green, & Co., 1884.)—In this very well-executed work Mr. Hunter explains and illustrates various devices applicable to the solution of the more intricate types of arithmetical problems; artifices, of course, akin to those by which algebraical equations are solved. His book may be commended to all who wish to work questions in Higher Arithmetic at once with intelligence and facility.

*Leaves from my Note Book.* By Thomas Allen Reed. (London: F. Pitman. 1884.)—This is a history of Mr. Reed's own life as a reporter, printed in reporting phonography, beneath which appears a verbatim transcript in "language understanded of the people." One catches something of the author's enthusiasm for his art from its perusal.

We have also on our table *Society, The Medical Press and Circular, The American Naturalist, The Journal of Botany, Bradstreet's, The Railway Review, The American Druggist, The Gardening World* (a new and, apparently, excellent paper), *The Tricyclist;* from Messrs. Cassell & Co., *An Old Testament Commentary,* by the Bishop of Gloucester and Bristol, *European Butterflies and Moths, History of the Franco-German War, The Library of English Literature, The Countries of the World, Cassell's Household Guide, Cassell's Popular Gardening,* and *The Book of Health.* Also *The Hindu Excelsior Magazine, The Church of England Temperance Chronicle,* and a *Catalogue of the Exhibits from the Department of Education of Japan.*

## THE FACE OF THE SKY.

From October 24th to November 7th.

By F.R.A.S.

The student will not neglect his daily watch on the Sun for spots, faculæ, &c. Maps X. and XI. of "The Stars in their Seasons" may be consulted for the configuration of the night sky. Mercury is a morning star during the succeeding fortnight, but is approaching the Sun and getting into a bad position for the observer. In fact, he comes into superior conjunction at 8 o'clock at night on November 4. Venus is a morning star, too, and a brilliant object before sunrise. Mars is invisible, but Jupiter is coming into view now in the east in the early morning, rising about 56 minutes after midnight to-night, and about a quarter past twelve o'clock on the night of November 7. No phenomena of his satellites occur at anything like convenient hours for the ordinary amateur during the next fourteen days. Saturn is visible during all the later working hours of the night, and is in every respect a splendid object now. He is, as stated a fortnight ago, still a little above ζ Tauri, which he is approaching. Uranus has left us for the season. Neptune has scarcely moved perceptibly from the position in which we left him. The Moon enters her first quarter at 4h. 54·4m. a.m. on the 27th, and will be full on November 3 at 8h. 37.8m. a.m. No less than eight occultations of stars will happen at convenient hours during the period covered by these notes, so that the juvenile or incipient astronomer who possesses a telescope has a treat in store for him. On October 27th the 6th mag. star 8 Aquarii will disappear at the moon's dark limb at 8h. 44m. p.m. at an angle of 109° from her vertex, to reappear at her bright limb at 9h. 50m. p.m. at a vertical angle of 343°. On the 30th, 11 Piscium, a 6½ mag. star, will disappear at the dark limb of the moon at 7h. 26m. p.m., at a vertical angle of 120°, reappearing at her bright limb at 8h. 37m., at an angle of 274° from her vertex. Later on on the same night, at 10h. 27m., 14 Piscium, a 6th mag. star, will disappear at the moon's dark limb, at an angle from her vertex of 152°, and reappear at her bright limb at 11h. 35m. p.m. at a vertical angle of 302°. On November 4 63 Tauri, of the 6th mag., will disappear at the moon's bright limb at 9h. 40m. p.m., at a vertical angle of 66°, reappearing at her dark limb at 10h. 44m. p.m., at an angle from her vertex of 246°, two minutes after the occultation of 63 Tauri (*i.e.*, at 9h. 42m. on the same night; the 6½ mag. star B.A.C. 1351 will disappear at the bright limb at an angle of 36° from the vertex of the moon, reappearing at her dark limb at 10h. 38m. p.m., at an angle from her vertex of 278° On November 5, 115 Tauri, a 6th mag. star, will disappear at the Moon's bright limb at 10h. 2m. p.m., at an angle of 101° from her vertex, and will reappear at her dark limb, at a vertical angle of 194°, at 10h. 46m. p.m. Lastly, on November 7, 68 Geminorum, a star of the 5¼th mag., will disappear at the bright limb of the Moon at 11h. 14m. p.m. at an angle of 35° from her vertex, to reappear at her dark limb at 12h. 14m. p.m., at a vertical angle of 237°. The Moon in Sagittarius all day to-day, to-morrow, and until 6h. 30m. p.m. on October 26, when she enters Capricornus. This she crosses by noon on the 27th, and passes into Aquarius. She continues in Aquarius until 10 a.m. on the 30th, when she enters Pisces, her passage across which great constellation is not completed until 11 a.m. on November 2. She then passes into Aries, which it takes her until midnight of the 3rd to cross. Entering Taurus at this hour, she travels through it until 9 a.m. on the 6th, entering at that hour the narrow northern strip of Orion. Leaving this at 8 o'clock the same night, she passes into Gemini, in which constellation she still remains when these notes terminate.

## THE ECLIPSE OF THE MOON.

Dr. WILSON writes from Chester:—"In Chester, eclipse on Oct. 4 was different from any I ever witnessed. The moon's brightness and light, which were specially clear, were not sensibly diminished during the time she was in penumbra, but in umbra she was as effectually obscured the whole time, as if blotted out of existence, although the sky was quite clear, and on emergence into penumbra she shone out again with full brilliance. But at Broxton, only about twelve miles S.S.E. from Chester, she was distinctly seen of the usual copper colour all through the umbra. A brilliant meteor, of greenish colour, was seen here last night (Oct. 12) in N.W. at 10.30 p.m."

Dating from Worthing, Mr. Ernest Overington says:—"I commenced observations about half an hour before the first contact with the shadow, and continued them up to half-past eleven. During the first part of the partial phase, the part of the moon in the shadow was faintly visible in my instrument (a three-inch achro-

matic) with just a faint tinge of green. As it approached totality it grew a little brighter, but the green tinge disappeared and gave way to the usual coppery colour. During the total phase the moon was faintly visible, and both to the naked eye and through the telescope appeared of a coppery colour, which colour she retained up to the time I discontinued observations, the only time she appeared green being for a short time after the commencement of the eclipse."

From Wellington College, Mr. P. H. Kempthorne writes:—"Having observed, in more than one account of the eclipse of Saturday week, that the moon was said to be invisible, or nearly so, during totality, I think it may be worth while to state that here the outline was visible to the naked eye at all times. The disk was of a dull coppery hue. My 8½-in. mirror showed a fair amount of detail. The surface, in colour, was that of a bright copper-kettle somewhat irregularly tarnished by common use. The darker portions did not altogether correspond with the darker portions of the lunar orb."

And E. C. R., from County Meath:—"The eclipse was well seen here as in most places, and several observers who saw the commencement tell me that they were unable to see the moon at all when they looked for it between 9.30 and 10 that night. This seems strong evidence to show that none of the light usually seen on the eclipsed surface of the moon is due to phosphorescence caused by its long exposure to sunlight."

[Here, again, we have the most curious discrepancies as to the visibility of the moon during totality, and the colour of the earth's shadow. That some of them had their origin in local atmospheric causes is pretty obvious; but this explanation is far from reconciling them all.—Ed.]

## Miscellanea.

Camels are, it is said, to be employed as the motive power on the last section of the railway built by Russia through the Trans-Caspian desert, toward India.

It may be mentioned that on the 10th inst. a twelve-coach Midland Scotch express ran clean through Bedford station before it was stopped, in consequence of the failure of the leak-off vacuum brake.

It is stated that Mr. W. F. Brearey has succeeded in inducing the authorities of the International Exhibitions at South Kensington to include aëronautics in the programme for next year, and it is probable that some experiments in balloon steering will be made.

The Earl of Rosebery is to be the first president of the projected Scottish Geographical Society, and the inaugural address will be given in Edinburgh towards the end of December by Mr. H. M. Stanley. The promoters of the society will aim at establishing a magazine which shall be a popular record of the leading geographical events of each month.

Royal Victoria Hall and Coffee Tavern, Waterloo Bridge-road, S.E.—The committee of the above hall have been enabled to arrange another series of penny science lectures. On Tuesday, Oct. 28, J. W. Groves, Esq., will lecture on "Plant and Animal Mimics," and on Tuesday, Nov. 4, the Rev. W. Tuckwell will lecture on "A Bank Holiday on the Hills."

The London and North-Western Railway now includes four separate lines laid upon 114 miles, and three lines upon 28 miles of its railway. The Midland Company has 66 miles of four lines, and 21 of three lines. The Great Northern is laid with four lines for 24 miles, and with three lines for 30 miles. There are now over 400 miles of railway in England laid with three or more sets of rails, and the estimated cost of the widening has been twelve millions.

At a meeting of the Birmingham Tame and Rea District Drainage Board held last week, the Works Committee announced that thirteen contracts had been entered into for various operations, ten of which were already completed and the others far advanced. Alderman Deykin stated that the Board had now practically arrived at the close of their operations, and that at that moment the whole of the sewage of Birmingham was flowing into the river Tame in a perfectly innocuous condition.

Lectures on Sanitary Matters.—Miss Barnett, of the National Health Society, 44, Berners-street, W., has again started on a lecturing tour in the provinces. Manchester, Carlisle, Keswick, Workington, Cockermouth, and many other towns are to be visited. Her subjects are likely to prove attractive at a time when sanitary precautions are more than ordinarily needed:—"How to oppose the Cholera," "Prevention of the Spread of Infectious Diseases," "Air and Ventilation," "Good Food," "Sensible Dress," "Management of Infants," and kindred subjects, are all treated in a simple, practical manner, and we cannot help wishing that such teaching could be constantly and thoroughly carried out in every town and village of the United Kingdom. That "Prevention is better than cure," is a motto we should all do well to remember.

A New Caoutchouc.—It is reported, says *Engineering*, that the attention of the Indian Government has been drawn to a tree in Southern India, from which large supplies of caoutchouc can be drawn. This is the "Tuchmig" of the Chinese, or *Prameria glandulifera* of botanists. Unlike the South American tree, from which the caoutchouc is tapped by piercing the bark, the gum is obtained from the new source by breaking the boughs and drawing it out in filaments. If the new caoutchouc is at all equal to the old in insulating properties, it will form a timely discovery, for the introduction of electric lighting has created an increased demand for india-rubber coated wires. Indeed, several inventors have lately been engaged in trying to manufacture a substitute for gutta-percha and india-rubber out of oxidised oils, that is to say, oils treated with chloride of sulphur, mixed with asphalte, ozokerit, and other insulating substances.

A Singular Experiment.—The *Fish Culture Journal* states that the truth of the assertion recently made by an American authority to the effect that brandy acts as an immediate means of revivifying fish on the point of expiration, has been completely vindicated by Mr. W. Oldham Chambers, secretary of the National Fish Culture Association, who conducted an experiment in the presence of several gentlemen at South Kensington on the 1st inst. Taking two Prussian carp from the tanks of the Aquarium, he deposited them in separate dry cans, adorning one with blue ribbon to distinguish it from the other, which was selected for the administration of spirituous liquors. After a lapse of four hours the fish were placed in water, evident signs of expiration being apparent in both cases. A small quantity of brandy and water was then given to the carp selected for the imbibition of intoxicating liquors through the medium of a feather, and no sooner was the fish replaced in water than it was quickly restored to vigour and strength. The carp enlisted under the banner of the "Blue Ribbon League" to all appearances died half an hour after its more fortunate associate, and was taken out of the water and thrown on the ground. About four hours later, however, the fish was picked up by Mr. Chambers, who observed it by appearance to be *in rigor mortis*. He at once operated on the seemingly inanimate fish by opening its mouth and pouring a dose of brandy and water down its throat and again putting it in the water, when, to his astonishment, he noticed slight signs of animation. For five minutes the unfortunate object of the experiment floated helplessly on its side, when presently, to the still greater amazement of Mr. Chambers and those who watched the experiment, it gradually asserted itself in the water, and with considerable effort made use of its fins—feebly at first, but afterwards energetically. Both the resuscitated fishes, who show no signs of their late prostration, are now in the tanks as usual. [These experiments, however, although remarkable, are not altogether new, similar ones having been performed by the authorities of the Brighton Aquarium.—Ed.]

Railroads of the United States.—The seventeenth annual issue of "Poor's Railroad Manual," which has just appeared, fully maintains the high reputation heretofore attained by this publication. It is a complete compendium of information touching the railroads of the United States, giving their length, equipment, share capital, funded and floating debts, cost of roads and equipment, traffic operations, earnings and payments, &c. All who have investments in such property, or who think of thus employing their means, cannot fail to do so with a better understanding after looking over the facts presented in this volume. There were 6,753 miles of railroad built in the United States in 1883, making a total length of 121,592 miles of road built up to the 1st of January last. America has nearly half the railroad mileage of the world, Germany, Great Britain, France, Russia, and Austria following next in order, but the length of American railroads considerably exceeds that of all the European lines combined. The total amount of liabilities of American railroads, on account of stock and debts, is now 7,495,471,311 dols.—an enormous amount, certainly; but it appears that their net earnings for 1883 were 4·49 per cent., which is an extremely good average, when it is remembered how largely their stocks and bonds have been watered. The "Manual" estimates the actual cost of these railroads at only about one-half of the amount of their funded and floating debts, and that they are thus really paying an annual interest equal to 9 per cent. of their cost. The railroad freight transported in 1883 amounted to 400,453,439 tons, the value of which, at only 25 dols. to the ton, would have exceeded 10,000,000,000 dols. The total length of all tracks was 149,183 miles, of which 78,491 miles were laid with steel rails. The number of locomotive engines employed was 23,823; of freight cars, 748,661; of passenger cars, 17,899; of baggage, mail, and express cars, 5,948.

"Let Knowledge grow from more to more."—Alfred Tennyson.

*Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.*

*All Editorial communications should be addressed to the* Editor of Knowledge; *all Business communications to the* Publishers, *at the Office, 74, Great Queen-street, W.C.* If this is not attended to delays arise for which the Editor is not responsible.

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No communications are answered by post, even though stamped and directed envelope be enclosed.

## MIND AND BRAIN.

[1467]—I see that your correspondent, "F. W. H.," "in the interest of truth only," has attempted an answer to the query which I put in my former letter. In the same interest, I could have wished that the answer were more satisfactory, and more to the point. For where, I ask, lies any *true* analogy between the purely mechanical action of light waves passing through a prism, so producing colour, and the production of intangible thought from the brain by the conscious effort of the human will? Such similes are, almost, proverbially dangerous and misleading. "F. W. H." has entirely missed my point. If his comparison has any bearing whatever upon the subject, the lecture which he supposes, on geology, or astronomy, or theology, might be likened to the ray of light which, being brought to bear upon the prism of the brain, produces certain differently coloured thoughts, so to say, in its passage through the brain of the hearer. But my question is, whence come the stimuli when the force of extraneous circumstances fails to account for them? Whence comes the power, which, in the form of will, uses the brain as its instrument, and compels it, without any assistance from external surroundings, to vibrate in such a manner as to do the particular work, to produce or evolve the special chain of thought which I will it to do? Whence, in a word, arises this dominating power of will over the vibrations of the brain in the production of thought? The letter of F. W. H. has thrown no light whatever upon this question. S. F. B. Peppin.

Does the thought produce the vibration of the brain, or does the vibration of the brain produce the thought?

## WOLF'S COMET.

[1468]—During a short interval of clear sky, I picked up the new comet last night in my $2\frac{3}{4}$-inch. It is conveniently near $\varepsilon$ Pegasi now, and appears like a nebulous patch. A. N. S.

[1469]—I obtained a good view of this object last night. With 6-in. reflector it appeared as a slightly elongated nebulosity with central condensation, and perhaps just a suggestion of a tail. Determining its position from $\varepsilon$ Pegasi, I found it approximately R.A. 21° 33′ (N.B., 12° 26′, instead of 12° 5′ as given in the Dunecht circular quoted in Knowledge). The declination was corrected for the time given, viz., 11h. 6m. p.m., and is, I feel sure, correct within an outside error of 2′. E. S. Beaven.

Warminster, Oct. 12, 1884.

## SHOOTING STARS AND METEORS.

[1470]—Mr. W. H. S. Monck seems to misunderstand my letter (1405).

I did not say that under the conditions alluded to the orbits of the shooting stars would not be altered; on the contrary, I believe they would. I only submitted on ocular grounds that the earth could not be their centre.

I think it is generally supposed that the great bulk of meteors which enter the earth's atmosphere, after disintegration by vaporisation, solidify in the form of dust, and so imperceptibly reach the earth's surface, while a small remainder, undergoing a trifling disintegration fall in a solid heated mass as aërolites. Eye-witness.

## INFLUENCE OF MOONLIGHT.

[1471]—As I can speak from personal experience, I shall have much pleasure in giving you my opinion upon the subject. When a youngster, twenty years ago, I had the same impression as your correspondent's friend had, and implicitly believed that sleeping under the direct rays of the moon caused blindness, and I remember reading of a girl that, I believe, quarrelled with her parents and slept in a corn-field all night, and it was said that she became blind, during the night, from the action of the rays of the moon, but I cannot vouch for the truth of it. My opinion was completely modified when I was forced, from too much company in my bunk (of the heavy dragoon tribe), to seek rest on deck for six weeks, whilst the ship I was in was at Hong-Kong and Foo-Chow (I was a sailor then), and I remember I used to try to get where the moon did not shine upon me fair, but I never could, for what with the swinging of the ship and course of the moon, I repeatedly awoke with the moon shining full in my face, and suffered no ill-effects of the same. My opinion is that, if the sleeper has his eyes closed, no harm will come to him; but, if in the habit of sleeping with his eyes open or *partially* open, then the rays of the moon *may* have an injurious effect, for the bright light in Egypt causes ophthalmia. I can say nothing about the fish not keeping. I may mention that the dew fell very heavily, and that nearly all the crew slept on deck, but not one that I knew was affected.—I remain, dear sir, yours truly, R. J. Symonds.

[1472]—In reply to the question of your correspondent at p. 305, as to the influence of moonlight, it is one to which I have given my attention as a medical man, resident in India over twenty years, and during several voyages there and back. I have never been able to make out that the light of the moon had any influence whatever, but came to the conclusion that all the evil effects attributed to it arose from muscular rheumatic affections produced by sleeping—not in the moonlight—but in a draught or cold air. Sailors who, after a hot day in the tropics, lie down to sleep with their heads in an open port, are subject to attacks of the kind, and if the moon should have happened to shine in on their faces they attribute all the results to it, instead of to the effect of the cold air. What is called in the tropics moon-blindness, is quite a different matter. This occurs among weakly and badly-fed natives from other very obvious causes, and is a weak condition of the eye, which prevents them seeing well after dusk. B. M., F.R.C.S.

## THE ECLIPSE OF THE MOON.

[1473]—In reference to your remarks in "Editorial Gossip," in your last number, on your own observation of the lunar eclipse, permit me to state I observed the same phenomenon, excepting the green-tinted ring. I did not observe the ingress, being engaged within doors. A friend entered and said the eclipse was total. I immediately went out and found that my friend did not clearly distinguish the difference betwixt *umbra and penumbra*, which I never before saw so clearly defined. Just before totality I again went into my room, not staying there more than two or three minutes, when, on returning to the garden, I had some difficulty in finding the exact place of the moon, so thoroughly was she obscured—any trace of light was absent. I have previously observed during an eclipse the moon's peculiar hue, but on this occasion I could not see the dark body of the moon without considerable effort. The skies were cloudless.

During egress, I could well observe that the diameter of shadow was much larger than the diameter of moon, but when about six-tenths of moon's disc only was in shadow, the segment of moon's bright side did not appear as any part of a circle, but rather of a parabolic curve.

Was this appearance an optical illusion, or was it more likely to arise from defective vision? Pardon my intrusion.

William J. Davies.

[The moon's diameter may be taken to be 2,160 miles; that of the earth's shadow at the moon's distance from us on the night of the 4th, as 5,879 miles. Does Mr. Davies mean that the moon's limb or the edge of the shadow on her surface showed parabolic curvature?—Ed.]

## EXPOSITORY THOUGHTS ON THE CREATION.

[1474]—I have read the very unfair and indiscriminate critical notice of this my book, in your number of August 29 last, and in common justice to me I hope you will be kind enough to insert this letter in answer thereto, in an early issue of your periodical.

Passing by your general summary of the work as "hopeless nonsense," as scurrilous in the extreme, to say the least of it, I beg to say that I do *not* in my preface "*deprecate* adverse criticism on the

somewhat incoherent grounds that the work was written when the writer was but temporarily engaged in his calling; that neither leisure nor learning properly so called has been brought to bear upon it; that the life experience of its writer has been mainly gained in another and far different sphere—viz., in a department of the legal world; and to a consequent lack of sufficient knowledge of natural history and other branches of learning and research;" *nor* do I "put forward my ignorance of the subject on which I treat as a reason why I should be tenderly dealt with."

The words in the preface, "when the writer was but temporarily engaged in his calling," refer to the *time when the work was written;* the statements, respectively, that "neither learning nor leisure (properly so-called) has been brought to bear upon it, and that the life-experience of its writer has been mainly gained in another and far different sphere," &c., are, *inter alia*, adduced as reasons for the admission made that the writer "lacked sufficient knowledge of natural history and other branches of learning and research necessarily involved in his wide-ranging subject," *to deal therewith* in a comparatively *exhaustive manner*.

I refer the critic to the preface, and ask his candid acknowledgment whether this my construction of it is not a fair one.

I do not put forward my "ignorance of the subject" as a reason why the book should be tenderly dealt with, but, rather, *some* of the various circumstances which were unfavourable for enabling me to treat the matter fully, and as an entirety; and, by-the-bye, I do not ask for *tenderness*, the words are "in the hope that it will meet with a *fair*, and favourable, and even a *kind* reception.

Lest your readers should be misled by what the critic styles my "polytheistic exordium," I would merely say that the first chapter of the work states that "the teaching of revelation respecting God is that there are three persons, all equal, save in point of age, who, together form the God-head—*i.e.*, the Christian triune God, the Father, Son, and Holy Spirit," and that such first chapter also gives in evidence of such statements various texts of Scripture.

Respecting the criticism of the meaning of the word "day," I still adhere to my opinion that each day was an Age, and each Age was 100,000 years in duration.

I may hereafter, in another work, present my views with respect to the words, "the evening and the morning were the first (and each succeeding) day;" but I do *not* calmly put Exodus xx.—8, 9, 10, and 11 verses out of sight altogether; on the contrary, I, in effect, affirm in Chapter ii. that the seventh day referred to in Exodus was sanctified as a memorial time of rest from usual labour, exercise, and occupation.

The critic then (professing to give a sequence of *my facts*) asserts that the *female* deity, by a corporeal act, originated the compound elements of nature, which are five in number (and he names them), and states that "then the wind, salt, &c., began moving and rotating. Globules were poised in space." Now, I submit with all confidence and firmness that such assertions are inaccurate in an eminent degree; such statements present a garbled distortion of facts, and tend to pervert the judgment of the public respecting the book, and to injuriously affect the reputation of the author of it.

The work *really* states that the corporeal act was wrought conjointly by God the Holy Spirit and God the Son, and that its result was the poising in space of a number of globules, &c. (or the origination of the compound elements of nature), and that these compound elements or these globules (see p. 23) immediately began to move rotatorily and in circles from left to right, or west to east, &c.

The air, at first thin, the critic says, became thick; the book says, *after a lengthy period, gradually* the temperature rose from the intense coldness which first prevailed, and the air became more dense, and that still *by steps* advancing in its density it reached its ultimate degree of thick unctuous vapour.

The critic then says "the sea began to be developed, and that by virtue of the generating elements composing it, and those of air being in constant and two-fold motion, there gradually started into being multitudes of animalculæ, and microscopic life." The book gives the gradual natural steps by which the unctuous vapour *gradually* formed the seas, and then (in the fifth chapter), it states that "immediately the sea began to be developed, or soon after, by virtue," &c.

Then with an audacity most unbecoming his official capacity, the critic states, "With this start, the transition to shell-fish, and many marine creatures. . . . who attained unto immense size" presents no difficulty at all, or, at all events, as little as the method in which their deposits formed at last by far the greater portion of the earliest earth-crust, namely, that composed of chalk and lime; whilst the book says, "As the sea *gradually* further formed, *larger* and *higher creatures* in *natural* and *graduated order*, such as *zoophites*, *mollusca*, and *radiata*, became evolved," and that "*before* the *close* of the *first era*, there doubtless became evolved many marine creatures (now extinct) who attained unto immense size, and that in course of many thousands of years the deposits o such marine living creatures, and the remains of such as died would constitute a vast amount of matter, which, decomposing and disintegrating would go to form at last by far the greater portion of the earliest earth-crust," &c.

The critic then makes contemptuous reference to the assumption that the icthyosauri, plesiosauri, and megatheria existed during the third age. I submit that I have endeavoured to give a sequentiality of reasoning in the work in evidence of my contention.

The critic's equally supercilious reference to the alleged mode by which the air was formed does not produce in me any change of opinion respecting it; in fact, I am convinced that I am right. I notice, however, that he omits a by no means unimportant point respecting the component globules or vesicles, viz., their form. The book states their form was twofold—spherical and spheroidal.

The critic then proceeds to make the erroneous statement or implication that, according to the author, the sparrow and redpole were created on the third day (or era), with certain other species of birds which he names. The book makes no such statement; but says, in guarded language, that there existed during, or at the end of such age, the *first* species of the penguin tribe, the *first* species of the petrel genus, the *first* species of the crane tribe (or ancient Dinorni), and the *first* species of small aërial birds included in the insectivora genus, ending in the ultimate forms of sparrow and redpole in the *fifth* species, &c. The first species of the small aërial birds is described in the seventh chapter as being *white* of *two varying shades*, like the binary-coloured earth-crust of the period (the author submits that such species was the plovers).

If the critic had carefully read and well considered the work, he would have discovered that only one species (of five) is declared to have been evolved in one age; therefore, the sparrow and redpole (being the *fifth* species of the small aërial birds) would not be evolved until the present (or seventh) age.

Pursuing his disdainful way, the critic next sceptically questions the sequence or locality (or both) of the formation of the primordial metals of the three several genera, and, instead of giving reasons for his scepticism, he emphasises the metal, brass, by adding three points of exclamation thereafter, by way of showing, as I assume, and that bombastically, his own superior intelligence to that of the writer.

The writer, nevertheless, is not shaken in his views respecting the metals, which, he submits to the public, he has put forth clearly and in well-defined language in his treatise.

Then the critic, towards the close of his review, makes a curt and scornful allusion to the natural evolution or generation of Adam solely by a female gorilla, and also to that of Eve as set forth by the writer. The writer, however, notwithstanding such despisal thrown upon his views concerning such evolution, begs to say that he holds them as firmly as before, because he is *convinced* that they are *really true*, distasteful and humiliating as they *may appear* now, after thousands of years, to many of the excellent, the refined, and highly cultivated of our race.

After indulging in some general scurrilous and vulgar abuse, the critic ends by proffering the writer certain gratuitous advice, and refers him to Matt. xv., 14. Having been obliged to make this letter inconveniently long, the writer does not propose to animadvert upon such abuse; and, with respect to the advice, as it is of no service to him, the writer declines to take it, but suggests to the critic that, as in its appropriateness it rightly belongs, or is more suitable, to him, that he should keep it, and may it do him good.

J. R. Smith.

[An apology may seem necessary for occupying so much space with the above letter; but I am moved to insert it by two considerations. The first is the unfairness of condemning any man unheard. The second, the opportunity it affords the readers of the original review of judging for themselves, in the light of Mr. Smith's verbal emendations, how far the severity of his critic was justified. Mr. S. seems to consider that he proves an assertion by reiterating it. His wonder that the reviewer put three notes of admiration after brass as a "primordial metal," may possibly diminish when he learns that brass is an artificial alloy formed of copper and zinc by human hands, and that it *never* occurs in a native state. The oily and watery globules, the wind and salt, &c., may safely be left to speak for themselves.—Ed.]

## FUNGOID GROWTH ON DEAD FLY.—THE ECLIPSE.

[1475]—Probably the fly, about which "St. John" wants an explanation (Letter 1449), died from an attack of its fungoid parasite, *Empusa muscæ*.

The insect in question would likely be glued to the ceiling by a

viscid fluid exuding from the tubular hairs surrounding its pulvilli, and which ordinarily enables the fly to walk in any position, but continues to flow after the victim, from the destruction of its viscera, &c., has become too weak to move; it then becomes covered with a white powdery efflorescence, consisting of the stems and sporangia of the fungus.

The fly has dropped from some cause, fallen upon its back, and scattered the fungoid growth about the place where it struck.

*Empusa muscæ* appears to be the aërial form of *Sapsolegnia ferax*, the fungus which has caused so much destruction to salmon in many rivers of late years; hence, those who have aquaria should on no account feed fish with flies, as this practice may introduce a supply of germinating spores certain to kill the inhabitants.

Anent note on eclipse of 4th inst., p. 302, "Editorial Gossip," here at Newcastle-on-Tyne, the moon's place at totality could only be distinguished by a faintly luminous spot. A field-glass was required in order to bring the dusky disc into view. The night was fine, with some haze, but the more conspicuous stars were all visible. M. H. Robson.

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[1476]—Your correspondent, St. John, in the last number of Knowledge, mentions having found a dead fly surrounded by a multitude of spores. He may be interested to know that flies at this time of year are often killed, as his evidently was, by a fungus (*Empusa muscæ*). This fungus attacks house-flies and completely fills their bodies, which become very much swollen with its spawn or mycelium. The segments of the body are stretched far apart, and the fungus protrudes through the thin connecting membrane, which is thus studded by numberless small, transparent bodies, shaped much like a child's ninepin, but with no neck, packed close together. When ripe, the head or spore is apparently thrown off with some little force, and forms the dust-like appearance round the fly. I was examining a fly, attacked by this fungus, under the microscope the other day. Between the segments were white bands about the same width as the segments, which were entirely covered with these little glass-like ninepins, and formed a very beautiful object. G. S. S.

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## FOOD OF THE DRONE-FLY.

[1477]—Mr. H. J. Slack in "Pleasant Hours" for this week, Oct. 17, speaking of the drone-fly says: "Unlike the biting insects, the beetles, no solid particles suit these creatures."

I should like to call Mr. Slack's attention to the fact that all the members of the drone-fly group (*Synphidæ*), eat the pollen of flowers. The pollen, though small, is I think, quite solid. I have in my possession micro-slides showing the stomachs of various flies of the Synphidæ, containing pollen of various flowers on which the flies have fed. In dissecting dung-flies, and very large blue-bottle-flies that have fed upon dung, I have noticed very small particles of solid matter in the stomach. If Mr. Slack has not noticed this fact, I shall be pleased to send him a few micro-slides for inspection upon receipt of Mr. Slack's address. John Moore.

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## ESTIMATING DISTANCES.

[1478]—With reference to the excellent method quoted in your paper lately from *La Nature* of finding distances by a silhouette cut to size, I find an easy way of measuring distance when any people are in sight is to reckon a furlong distance to a man of average height when he appears half a degree high—*i.e.*, the breadth of either the sun or the moon against the sky. Half a moon high will, of course, mean double the distance—viz., a quarter of a mile. C. T. B.

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## LIFE AFTER DEATH.

[1479]—I read with much pleasure the letter of your correspondent, Mr. Selwyn Thorne, for I, too, take a deep interest in the question of a future life. But I do not see how Mr. Thorne could solve the problem, even for himself, by "shuffling off this mortal coil." He could only know that there is a future life, *if there is*; if there is not, he would not know that he had ever wondered or questioned about the matter at all, or, indeed, that there had ever been a *he* to wonder or a *question* to be solved. To quote the words that Mr. Howells, the novelist, puts into the mouth of one of his characters, "if we awake, we shall know it; if we do not awake, we shall not even know that we have not awakened."

A boy was drowned while bathing here at Worthing a few weeks ago. His body was brought to shore after it had been some time in the water. Every means were taken to reanimate it; but, unlike the case spoken of by your correspondent, these means were quite unavailing. Now, are we to believe that in the one instance the soul or spirit of the man was merely dormant within his body, while, in the other case, the boy's spirit was alive and awake, and conscious outside his body? If so, at what moment did he awake? Was he, perhaps, looking on at the futile efforts of those engaged in trying to bring him back to life in this world?

It would be pleasant to be able to believe something of this sort, but as you say, sir, in your review of Mr. Reynolds's book, "belief is *not* voluntary"; in spite of the preachers there is no such thing as *wilful unbelief*. A man has no choice but to believe what seems to him to be true. M. T. H.

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[1480]—We would have no cause to complain of your very wholesome rule which excludes theological subjects from the pages of Knowledge, if that rule were impartially enforced. I trust you will excuse me if I say (since I say it in no unfriendly spirit), that while you exclude the theological, you insert much that is anti-theological, and, in this, I think that we who believe at once in religion and in science, have some cause of complaint. The letter, for example, which appeared under the above heading is distinctly of this class. It is plainly an attack upon theologians—"those who teach the doctrine of a hereafter." Now, is this fair?

But more on this subject, as on every other, the scientific man and the theologian take entirely different methods. Your correspondent has adopted the theological, not the scientific, method, and then you, Mr. Editor, in your note, tie our hands and tell us that we must not reply by the same method. Science bases its conclusions on *phenomena*. Theology bases its conclusions partly on phenomena, but chiefly on *testimony*. Now, the reasoning of Mr. Thorne is altogether founded on testimony, and that of the most unsatisfactory and unreliable kind—*negative* testimony. We have some *positive* testimony on the same subject, but your rule excludes it—it is not "purely scientific." Neither is the reasoning of your correspondent.

Now, meeting Mr. Thorne, not on his own ground, but on the ground which you say must be occupied in this discussion, let me present some considerations both for him and for your readers.

1. The scientific conclusion from all that Mr. Thorne relates (admitting the correctness of his relation) is that the question remains untouched. As regards the mind and soul, there are no phenomena, therefore science gives no judgment in the matter. It could not be otherwise, for—

2. Admitting for the moment that the man was really dead, and that he had actually passed into another life, we can only argue here from analogy, and analogy would lead us to believe that in the time he would have gained no knowledge, and that his memory would retain no impression of that new life. For, in this world, at all events, it is only when impressions have been often repeated that the mind is affected. The mind of the newly-born infant does not even receive the idea of light for some time. In after years the mind is able easily to receive impressions of *combinations* of objects which have been made already familiar by repeated presentation; but, as far as we can know, if an unfamiliar phenomenon were to appear once, and only once, it would make no impression whatever either on mind or memory. And this is exactly what must have happened in the suppositious case before us. The man received no impression, because the mind was not prepared for such a sudden change.

3. But, as a matter of fact, the man was not dead. He was only unconscious. It is simply ridiculous to say that because a man is in a faint he is practically dead. If so, the number who were dead and have come to life again would be large indeed. I have myself gone through the process more than once. We would find, too, that it is not in every case that the mind in returning has no account to give of its period of seeming absence from the body.

4. To persons who, like Mr. Thorne, form their opinions on this subject from the evidence casually obtained on occasions like that which he narrates, we may fairly adduce the testimony of those who declare that they have been visited by deceased persons at the time of, or immediately after, death. Such evidence is at least as trustworthy as the merely negative testimony that "no symptom of change whatever" passed over the man who was unconscious. To us (poor theologians, who cannot argue scientifically) who believe that there is something more certain on which to found our belief than the testimony of unconscious or hysterical individuals, it matters little whether we receive such evidence or not.

Ballyboy Rectory, King's Co. John Healy, Clk., LL.D.

[By "much that is anti-theological," I can only conceive that Dr. Healy must refer to scientific conclusions opposed to his own views. How many scientific men, who are entitled to be listened to, now dispute the great antiquity and primitive savagery of the human race, and the doctrine of evolution? All of which my correspondent would doubtless regard as "anti-theological" in a high degree. Yet in this they have facts and not merely testimony to appeal to. I say boldly that there is *no* evidence in existence as so the appearance of a deceased person, upon which a

magistrate would dare to send the veriest tramp to gaol for fourteen days. For the rest, Dr. Healy's argument is temperate enough, and worthy of all serious attention, and on that account I insert his letter at length.—Ed.]

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[1481]—The following question seems to me to need an answer before it is possible to enter into the discussion initiated by Mr. S. Thorne, with any hope of its being a fruitful one.

Briefly this:—Let atoms of hydrogen, oxygen, nitrogen, carbon, phosphorus, and so forth, be arranged in precisely the positions they occupy in a human body—let motions be communicated to them precisely similar to the vibrations which the molecules of a normal human body are executing—will, or will not, the result be a sentient being?

I am unwilling to obscure the issue involved in the bare question by adding any hint at present with reference to my own opinion on the subject. F. G. S.

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## LETTERS RECEIVED AND SHORT ANSWERS.

P. Nevill. Thanks for cuttings; but the connection seems somewhat remote.—E. K. H. Oh, dear, no, it can "*not* be said that there were no occultations visible," as there were thirty stars between the 9th and 11th magnitudes over which the moon passed. But, *cui bono?* That rising of Saturn was a slip of "F.R.A.S.'s" to which his attention has been called.—J. B. Dimbleby. Thanks; but your chronological vagaries occupy too much space in your account of the Eclipse.—W. Jennings and W. Warsop. Delayed through your omission to address the *Publishers*.—J. H. B. I can quite understand "the leading organ of the wine trade" being irate with Mr. Mattieu Williams for his articles on the Cooking of Wine; nor do I suppose that the said organ loves me much more for my reproduction of some very remarkable items from a certain "Trade Circular" some time ago in "Editorial Gossip."—F. J. Wardale. The second edition of "Orbs around us" expresses the matured views of the conductor of this journal on the subject. See concluding paragraph (in capital letters) with which the Correspondence Column is headed.—E. S. Beaven suggests the Conservation of Mental Force as a contribution to the (now closed) question of Life after Death. Many thanks for the addendum to your letter.—R. Webb. Mr. Baker, 244, High Holborn, London.—E. Bradshaw considers that Transmigration supplies a solution of the Life after Death difficulty.—Thomas J. George. Mr. Proctor has entirely ceased to lecture. See Knowledge for July 18, p. 62.—H. A. Bulley. If you merely mean to indicate that psychical phenomena are influenced by the size, texture, and, notably, by the intricacy of the convolutions of the brain — yes; but there is a long step from this to the system of Gall and Spurzheim. — J. R. Smith. — Your letter marked for insertion. — John C. A. Stewart sends an account of a boy named Carroll, one of the crew of the ill-fated *Europa*, who refused to go in the ship on the day she sailed, on account of a dream that she sank after a collision (which, of course, she did).—Augustine Lee. You talk about "magnetic" sleep, &c., as though it was an objective, instead of a purely subjective phenomenon. You leave the question just where you found it.—More Light. You are quite right as to Dr. K. ignoring the refracted light from the photosphere. That from the Corona could not possibly illuminate the Moon's surface sufficiently to admit of its being analysed spectroscopically.—C. E. Doyle, T. H. S., F. W. H., and Jas. Spiers. You will see that the enormous mass of correspondence received on the subject has compelled me to close the controversy. — E. C. R. sends a list of the colours of prominent afterglows observed in County Meath between January 7 and October 11. They seem to have varied from white through red and pink to crimson.—Inquirer.—Undoubtedly a man reads English from *his own* left hand to his right; the only legitimate sense in which that word can be used. You surely would not say that (in a northern latitude) the sun travels from right to left from his rising to his setting?—J. N. Dawson. Write to Messrs. Watsons, 313, High Holborn. Thanks for offer of the cricket score, but we are utterly overburdened with matter.—E. Howarth. See reply to "E. K. H." above.—Arthur A. West. Thanks, but as you will see, already sufficiently replied to.—Rev. C. Carus-Wilson writes that he cannot definitely answer Mr. Beaufort's question, as he does not make his own tea; but that, weak or strong, the effect was the same.—Chas. Rice. Yes; but the only thing requiring elucidation is the mathematical reason why.—M. B. The system is really genuine, and would, I believe, be of service to you.—Selwyn Thorne, Rev. Wm. Fitzgerald, C. Ridley, Dr. Dyrter, and others, will see from the announcement with which this column concludes on p. 329, that the "Life after Death" controversy has now terminated. Such thoughtful letters as Mr. Ridley's, and one or two more which have reached me, cause me to regret that they did not arrive before these pages were closed to them.—Thos. Radmore. The only possible interpretation that I could place upon your original communication was that you imagined that the fore and after-glow were—or would be—in some way affected by the Lunar Eclipse. If you intended to express the exact converse of this I can only deplore that my limited knowledge of English prevented me from understanding you. Unless there is some novelty in your observations I should hardly care to insert them merely in corroboration of others already published, considering how much of interest is at present crowded out of our pages.—James Gillespie, 105, St. Michael-street, Dumfries, once more sends me an exposition of his "theory," filling a penny memorandum-book. This is, at least, the third time I have acknowledges the receipt of these essays here, and once or twice I have even pointed out the egregious fallacies underlying Mr. G.'s assumptions. It is, however, pretty evident that he does not read Knowledge, and expects a reply by post, which neither he—nor any other correspondent—will ever receive. If any of our readers are acquainted with Mr. Gillespie, they will confer a favour upon the Editor of this journal by inviting that gentleman's attention to this reply.—Samuel P. Cheeseman. Received.—J. N. A. We do not give the prices of books. They must be sought in advertisements proper.—Patrick McMananim. The article you send me is simply a very clumsy reproduction of the famous Lunar Hoax, of which the details will be found in "Myths and Marvels of Astronomy." There is no such a person as "Dr. Blendmann" in the Berlin observatory. No lunar photograph could by any possibility be taken through an object glass blackened with camphor smoke; nor would the most perfect one yet obtained bear magnification to the extent of 55 feet. There is not a scintilla of truth in the rubbish reproduced by the Mayo paper.—W. I am really grieved that my omission to insert your lengthy communication has made you so very angry.—Delta. The succession of the strata, the distances, magnitudes of the heavenly bodies, &c., are all correct, and this is all. As for the *deductions* from these, I am still thoroughly in agreement with you.—Pal. "Eye-Witness" treated the question from a purely scientific point of view, and, from such, quite fairly. Are you unable to distinguish between faith and *knowledge?*—Otto Overbeck. Thanks; but while certain of your subjects are foreign to those to which these pages are devoted, those which are more appropriate are already in the hands of competent members of our regular staff.—A Phrenologist. Wait until the series of articles is completed.—Eye-Witness. The mind and brain discussion must cease; it is drifting into a theological stage.—Faciebat. Yours is the only request, so far, received for an explanation of a graphical mode of representing the details of a Lunar Eclipse. The existence of a large amount of carbonic acid in the atmosphere during the epoch of the coal vegetation has been disputed, but certainly never "exploded." No; the "Workshop at Home" articles are not finished. The next will appear almost immediately.—Edward Preston. Received.

Whist.—Club Deuce. Undoubtedly a misdeal.

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# Our Inventors' Column.

*So great is the number of inventions now patented that many good things are comparatively lost in the crowd. A succinct account, therefore, by an Expert, of all inventions of really popular interest and utility must be advantageous both to the public and the Inventor, enabling persons to hear of inventions already desiderated by them, and thus acting reciprocally as a stimulant on supply and demand.*

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## IMPROVED LAMPS AND LANTERNS.

Mr. Joseph Rogers, of 16, Hanover-square, London, has patented an improved make of lamps and lanterns, in which, it is claimed, colza, or other vegetable or animal oils, may be burnt with a perfectly steady flame without the use of a chimney-glass, while at the same time a much more brilliant light is obtained than with the ordinary lamps with a less consumption of oil and wick. For this purpose a plate is slid into the bottom of the lamp upon which is an oil reservoir, preferably of the kind known as a bird's fountain, which supplies the oil to a wick tube projecting some distance up from the plate. Surrounding the wick tube is a tubular enclosure, also fixed to the plate, to the top of which is hinged a cap having a slit or opening arranged at such a height as to be a certain distance above the top of the wick. In the annular space between the enclosure and the wick-holder numerous perforations are formed in the base plate through which air can pass into the annular space, and in passing upwards the air is heated to a certain extent by

contact with the heated wick tube and enclosure, and is then caused by the cap to impinge against the flame, thus ensuring perfect combustion and a very brilliant, steady, and practically smokeless flame. The bottom of the lamp is formed with perforations for the entrance of the air, and perforations are likewise made in part of the base-plate surrounding the enclosing tube of the burner.

### A NEW BAG CLIP.

Messrs. John Southgate & Sons, of 75 and 76, Watling-street, London, have invented a new clip for the well-known "Gladstone" and other bags, designed to take the strain off the centre of the lock by holding the ends of the bag together. The originally-designed clip, which consisted of a metallic disc at each side, which was turned down so as to tighten upon the bag, was always untrustworthy, because it would work loose at any time; and then, again, anybody could easily and quickly undo it. An improvement on that was a sliding clip catching a hasp like that of a lock inside. This hasp constituted one of its defects, as also its liability to work loose, so as not to keep its place at all when tilted up. Messrs. Southgate & Sons, have now invented a clip which is claimed to be an improvement on anything else of the kind. It consists of a hinge on one side of the bag, which catches by pressure over a metallic catch or fastening on the other side, and to be undone requires the two sides of the bag to be pressed tightly between the finger and the thumb. It acts exactly like a spring-latch, one spring being in the upper part of the hinged clip, which resists slightly the attempt to push it down, and the other consists in the resisting power of the bag's mouth itself, which is sufficient to act as a permanent spring.

### AN IMPROVED LAWN-MOWER.

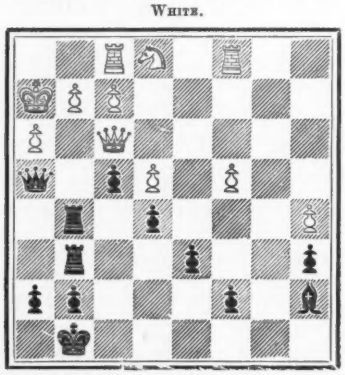
What is claimed to be an improvement in lawn-mowing machines has been invented by Mr. Thomas Knowles, of Turtin, near Bolton, in the county of Lancaster. The inventor says, in effect, that his invention is designed to prcduce a machine capable of cutting grass growing at the edges of lawns, or even the grass in borders or verges. To effect this purpose revolving blades, acting in conjunction with fixed knives, are placed on opposite sides of the frame of the machine. To this frame are secured bearings supporting an axle rotating therein, and carrying rollers at the ends. This shaft or bearing is connected with suitable gearing, or chain and gearing combined, so that motion can be transmitted from the axle carrying the rollers to the shafts on which the knives are mounted. The machine is propelled in the usual way by a handle. The rollers rotating the knives are placed in such a position that the blades operate on the grass to be cut previously to the drums pressing on the grass, and this, the inventor claims, gives facility for cutting grass on edges and narrow borders.

## Our Chess Column.

By Mephisto.

### ENDING FROM ACTUAL PLAY.

White.



Black.

| White. | Black. |
|---|---|
| 1. R to KKt6 | P × R |
| 2. R × P | Q to K2 |
| 3. R × RP (ch) | P × R |
| 4. Q to Kt6 (ch) | K to R sq. |
| 5. Q × P (ch) | Q in. |
| 6. Q × R (ch) | Q in. |
| 7. Q × Q check mate. | |

The following amusing game at odds was recently played at Purssell's:—

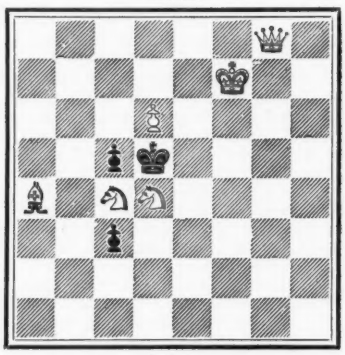
Remove White's King's Knight.

| White. Mephisto. | Black. Mr. S. |
|---|---|
| 1. P to K4 | P to K4 |
| 2. P to Q4 | P × P |
| 3. B to QB4 | Kt to KB3 |
| 4. Castles | Kt to B3 |
| 5. P to K5 | P to Q4 |
| 6. P × Kt | P × B |
| 7. R to K sq. (ch) | B to K3 |
| 8. P × P | B × P |
| 9. Q to R5 | Q to B3 |
| 10. Q to QKt5 | QR to QKt sq. |
| 11. B to Kt5 | Q to Kt3 |
| 12. Kt to Q2 | P to QR3 |
| 13. Q to QB5 | KB to KB sq. |
| 14. Q to Q5 | KR to KKt sq. |
| 15. Kt to K4 | B × Q? |
| 16. Kt to B6 (ch) | K to Q sq. |
| 17. R to K8 mate | |

### PROBLEM No. 133.

By B. G. Laws.

Black.



White.

White to play and mate in three moves.

### SOLUTION.

Problem 131, p. 308.

| | | |
|---|---|---|
| 1. K to B3 | K to Q4 | 2. Kt to Kt4 mate |
| | B × Kt | 2. K × P „ |
| | Kt moves | 2. K moves „ |
| | P moves | 2. K moves „ |
| | P to K4 | 2. P to Q5 „ |

### ANSWERS TO CORRESPONDENTS.

*** *Please address Chess Editor.*

M. Strong.—A pawn can only be taken *en passant* immediately after moving two squares, not afterwards. Although we can put eight Queens on the board without checking each other, we do not know the rule by which it is done. Perhaps some of our readers may know.

H. W. Sherrard.—Problem received with thanks. With your kind permission we shall make use of it somewhere else, as no animates are to appear in Knowledge.

Correct solutions received.—Problem 131, Donna, M. T. Hooton, A. W. Overton. No. 132, J. J. Cridlan, John Watson, H. A. N., W., Geo. W. Thompson.

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